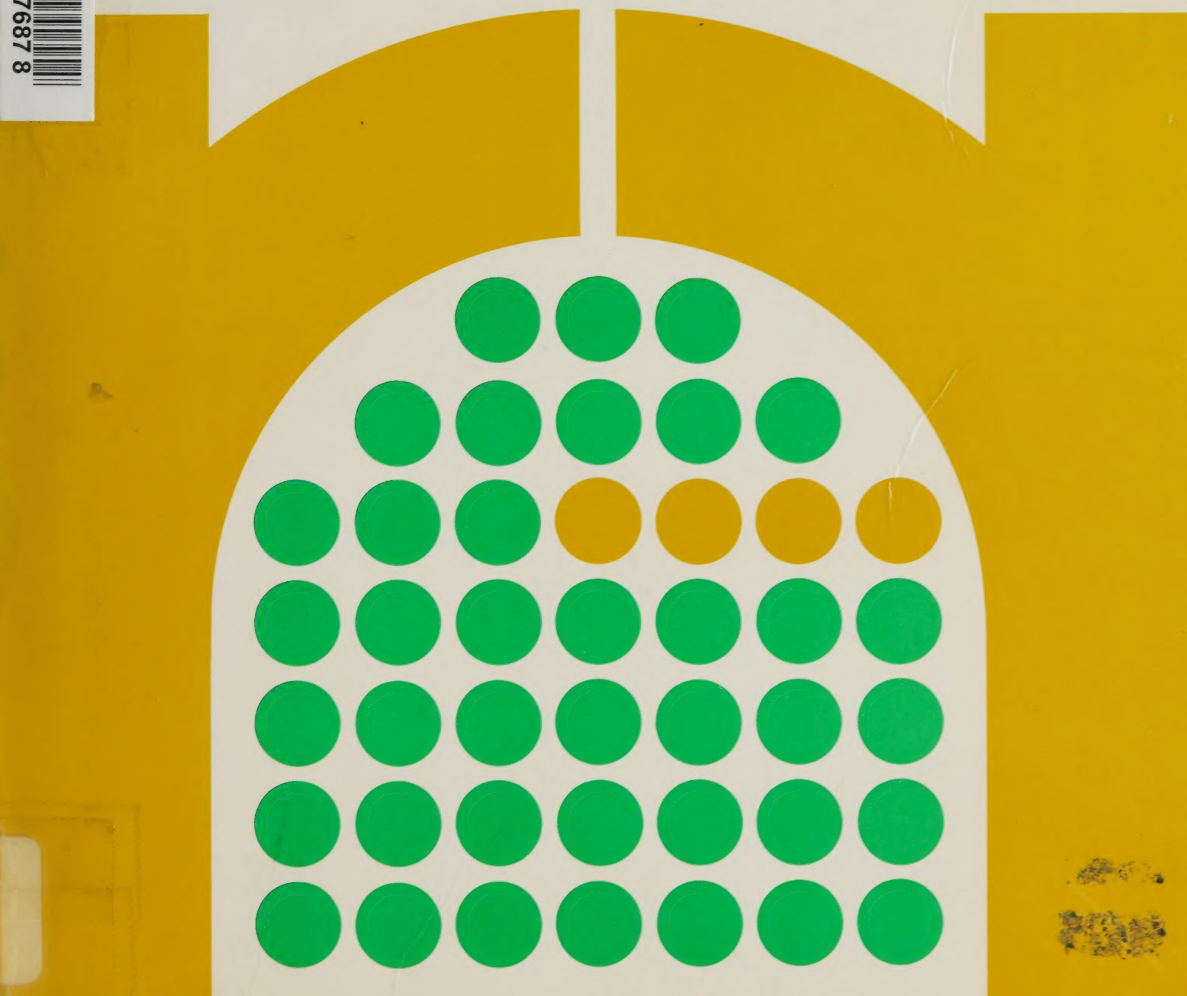
A series of background papers for discussion at the Resources for Tomorrow conference held in Montreal, October 23-28, 1961 in which resource management problems of agriculture, water, regional development, forestry, wildlife, recreation, and fisheries are considered, including their research, jurisdictional, administrative and information-extension characteristics.

Government Publication

3 1761 11557687 8



[Canada] [Conferences]
CA1 IA
61 R27

RESOURCES FOR TOMORROW



CANADA

Issued under the authority of

The Honourable Walter Dinsdale, P.C.,M.P.

Minister of Northern Affairs and National Resources

1961

Resources for Tomorrow

Conference Background Papers

Volume 2

July 1961

LIBRARY
DEC 29 1971
UNIVERSITY OF TORONTO

Eighty Background Papers were prepared to provide a body of information and references in advance of the discussions at the "Resources For Tomorrow" Conference in Montreal, October 23-28, 1961.

This collection of eighty papers is being issued in two volumes.

A third volume, on Conference proceedings, will be published after the Conference.

The staff of the Secretariat of the Conference are not unaware of the unconventional division of words at the ends of lines in this work. The need for such division stemmed from layout requirements, urgency and the close liason between editor and printer required to produce the two-volume work in the short time available.

ROGER DUHAMEL, F.R.S.C.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1961

Price $10.00 (2 volumes) Cat. No. R29–5261/2

Ottawa,
July 14, 1961

TO THE HONOURABLE WALTER DINSDALE,

CHAIRMAN,

STEERING COMMITTEE,

"RESOURCES FOR TOMORROW" CONFERENCE.

SIR,

Your Committee has given us the task to compile and collate material on renewable resources management and development in Canada, to serve as background material for the "Resources for Tomorrow" Conference to be held in Montreal, October 23 - 28, 1961.

We are now pleased to submit to you, Sir, this series of 80 background papers on topics relating to the following sectors: Agriculture, Water, Regional Development, Forestry, Fisheries, Wildlife, and Recreation. The selection of topics and authors was made after consultation with Advisory Groups made up of leading resource experts from all parts of Canada.

Respectfully submitted,

B. H. Kristjanson

B. H. Kristjanson,
Secretary,
"Resources for Tomorrow" Conference

Steering Committee

Hon. Walter Dinsdale, Chairman
Minister of Northern Affairs and National Resources
Government of Canada

Hon. J.W. Spooner
Minister of Lands and Forests
Province of Ontario

Hon. René Lévesque
Minister of Natural Resources
Province of Quebec

Hon. E.D. Haliburton
Minister of Agriculture, Lands and Forests
Province of Nova Scotia

Hon. H. Graham Crocker
Minister of Lands and Mines
Province of New Brunswick

Hon. Gurney Evans
Minister of Industry and Commerce
Province of Manitoba

Hon. Ray Williston
Minister of Lands and Forests
Province of British Columbia

Hon. Leo F. Rossiter
Minister of Natural Resources
Province of Prince Edward Island

Hon. A.G. Kuziak
Minister of Natural Resources
Province of Saskatchewan

Hon. Norman Willmore
Minister of Lands and Forests
Province of Alberta

Hon. W. J. Keough
Minister of Mines and Resources
Province of Newfoundland

Foreword

This series of background papers for the *Resources For Tomorrow* Conference is the product of an extensive collaboration among the eleven senior governments of Canada, industry, commerce, universities and private groups. The papers are intended to place before Canadians the challenging issues that lie ahead in meeting Canada's needs for improved management of her renewable resources.

The papers have two functions: First, they provide reference material for people of a wide range of interests seeking a basic insight into the nature of our renewable resource problems. Second, and more directly, they are designed to provide the necessary background information for effective discussions at the *Resources For Tomorrow* Conference in Montreal during the week of October 23–28, 1961. They constitute, in large part, the raw material for those discussions.

The Conference is under the direction of Ministers representing each of the ten provinces and the Federal Government. It had its origins in an announcement, on February 12, 1958 by the Rt. Hon. John G. Diefenbaker, Prime Minister of Canada, that a national conference on conservation would be called. This was followed by a letter from the Hon. Alvin Hamilton, then Minister of Northern Affairs and National Resources, to each provincial Premier inviting participation in a meeting to discuss possible plans for such a conference. All governments responded favorably to this invitation. The first meeting of the National Steering Committee for the Conference was held in Ottawa on November 17, 1958. Some modification and clarification of objectives occurred with the result that the Conference will have the following objectives: (1) identification of the major problems requiring attention in the renewable resources field; (2) examination of what is being done to solve these problems; and (3) clarification of the impediments to further progress and possible courses to achieving solutions to these problems.

The selection of subjects for background papers to assist in meeting these objectives was a formidable task. National Advisory Groups in each of the resource sectors were established to advise the National Steering Committee in this matter. The Advisory Groups suggested titles for the papers that would be required to meet the objectives, and they provided also a list of names of persons best qualified to undertake their preparation.

Preparation of these papers has been under the general direction of Mr. M. Miller, Associate Secretary and Director of Research. The major share of the responsibility, however, has rested with the following Research Co-ordinators: Dr. M. Brownstone, Deputy Minister of Municipal Affairs, Government of Saskatchewan, Regina, (AGRICULTURE); Dr. K. Kristjanson, Secretary, Advisory Committee on Water Use Policy, Department of Northern Affairs and National Resources, Ottawa, (WATER); Mr. E.S. Fellows, Forestry and Forest Products Consultant, Fredericton, N.B. (FORESTRY); Mr. W.M. Baker, Recreation Consultant, Hunting Technical and Exploration Services, Toronto, (RECREATION); Dr. D.A. Munro, Chief Ornithologist, Canadian Wildlife Service, Department of Northern Affairs and National Resources, Ottawa, (FISHERIES-WILDLIFE); Mr. L.O. Gertler, Director, Long Range Planning Division, City of Toronto Planning Board, Toronto, (REGIONAL DEVELOPMENT).

Authors have in several instances visited the capitals of all governments involved to obtain the most authoritative and up-to-date information available. In other cases surveys were made through mailed questionnaires. As a consequence, many authorities across the land have contributed to the material herein presented.

Editing of these volumes has been under the direction of Mr. G.P. Boucher, Economics Division, Canada Department of Agriculture, Ottawa.

Following the Conference, a third volume is planned. This will include major addresses as well as papers to be delivered on the opening and closing days of the Conference.

B.H.K.

Digitized by the Internet Archive
in 2022 with funding from
University of Toronto

https://archive.org/details/31761115576878

Contents

Section Five – Forestry

Demand Prospects for Forest Products. D.A. Wilson, 627

Potentialities of the Forest Resource Base. D.V. Love, 641

Using the Forest for Many Purposes. G. Tunstell, 661

Survey and Assessment of Forest Management Practices on Public Lands. J.W.B. Sisam, 669

Survey and Assessment of Forest Management Practices on Private Lands. R.S. Johnson and L. Holt, 683

Taxation and Tenures as They Affect Forest Management. A.M. Moore, 695

Survey of Forest and Forest Products Research Organization and Activities. J.D.B. Harrison and D.W. MacLean, 703

The Development of the Forest Industries. J.M. Smith and D. J. Forgie, 717

Review and Assessment of Present Forest Policies. W.A.E. Pepler, 731

Section Six – Fisheries

The Role of the Fisheries in the Canadian Economy. J.A. Crutchfield, 739

The Demand Outlook for the Canadian Fisheries. W.C. MacKenzie, 759

Productive Capacity of Canadian Fisheries – An Outline. W.E. Ricker, 775

The Effect of Man-Made Changes on the Environment of Fisheries. P.A. Larkin, 785

Survey of Legislation and Treaties Affecting Fisheries. S.V. Ozere, 797

Requirements in Fisheries Research. W.A. Clemens, 807

Information and Extension Work in the Atlantic Fisheries. A.F. Laidlaw, 815

The Management of Atlantic Salmon. C.J. Kerswill, 823

Scientific Names of Species Mentioned in Papers on Fisheries, 833

Section Seven – Wildlife

Wildlife in Perspective. C.H.D. Clarke, 837

The Economics of the Fur Industry in Canada. A.G. Loughrey, 845

Wildlife as a Recreational Resource in the Atlantic Provinces. H.F. Lewis, 857

Legislative and Administrative Limitations on Wildlife Management. D.A. Munro, 867

Emerging Problems in Wildlife Management. W.A. Fuller, 881

A Review of Wildlife Research in Canada. I. McT. Cowan, 889

The Organization of Wildlife and Fisheries Research in Canada. J.R. Dymond, 901

Problems of a Mobile Resource – Migratory Waterfowl. W.G. Leitch, 909

Pesticides and Wildlife in Canada. C. Cottam, 919

Elements of a Wildlife Policy. W.W. Mair, 931

Scientific Names of Species Mentioned in Papers on Wildlife, 937

Section Eight – Recreation

The Social and Cultural Aspects of Recreation. J. Farina, 941

Culture and Recreation in Montreal Parks. C. Robillard, 951

The Forces Shaping Demand for Recreation Space in Canada. L. Brooks, 957

Tourism in Relation to Natural Resources. H.L. Crombie, 969

Assessing and Allocating Renewable Resources for Recreation. W.M. Baker, 981

The Significance of Reservoirs in Recreation. J.A. Boan, 1003

Problems and Techniques of Land Acquisition. Joyce M. Tyrrell and Norah Johnson, 1009

The Organization of the Field of Recreation in Canada. E.R. McEwen, 1027

The Hierarchy of Government and Public Agencies in Park Development. E. Hardy and F.J. McGilly, 1037

Section Nine – General

Renewable Resources Information and Education in Canada. D.F. Symington, 1049

Index – Alphabetical List of Contributing Authors, 1061

Section Five: Forestry

93452—42

Demand Prospects for Forest Products

D. A. Wilson,
Head,
Economic Planning and Market Research,
Canadian International Paper Company,
Montreal, Quebec.

The forest industries account for the largest class of Canada's exports, providing 30 per cent of the total value. In 1960 the value of exports of forest products was $1,592 million. Newsprint, lumber and woodpulp together accounted for 90 per cent of the total; 79 per cent was shipped to the United States and 11 per cent to the United Kingdom. Canada accounted for 20 per cent of all wood pulp and 55 per cent of all newsprint produced in non-communist countries in 1959, and is the leading exporter of pulp and paper products. Canada is the world's leading exporter of lumber, supplying one-third of the amount traded.

Demand for paper throughout the world is expected to grow at a steady but moderate rate and consumption in non-communist countries is forecast to increase by 75 per cent in the next 15 years. Canadian industry should share in this increase by expanding exports to its present markets but new markets should also develop. Newsprint exports to the United States may increase by 2.2 million tons (42 per cent) and overseas shipments by 1.7 million tons (170 per cent) by 1975. An increase in pulp exports by 1.4 million tons (55 per cent) seems possible by that year. While increased exports of paper other than newsprint and paperboard are possible, present and foreseeable conditions make this seem unlikely.

Lumber consumption is expected to grow at a slower rate than that of paper and paperboard – for the United States a 20 per cent increase in consumption by 1975 has been forecast. Increased lumber exports to the United States and United Kingdom may be expected. While it is possible that shipments of lumber to other countries could increase, this does not seem likely at the present time. Lumber exports should increase by about 1.5 billion board feet (one-third) in 15 years. Exports of other forest products are now relatively small and are not expected to increase substantially. Export and domestic demand in 1975 will require about 55 per cent more wood than now used.

The above estimates are only possibilities and it is entirely possible that developments may occur which will restrict the future growth of forest product exports. Examples of such developments are: greater expansion of newsprint production in the United States, expanded exports by the U.S.S.R., development of pulp supplies in other overseas countries to supply Europe, and a larger expansion of European production than assumed here. The markets for forest products are large, they are expected to be increasing, but they are also expected to be highly competitive. An improvement of Canada's competitive position is essential if we are to share in this growth.

The importance of the forest products industries in the Canadian economy is suggested by several salient statistics: they provide 15 per cent of total manufacturing output, employment for about five per cent of the labor force, and account for 30 per cent of the value of Canada's exports – the largest single group in our balance of payments. Of the many forest products, three – newsprint, lumber and wood pulp – account for almost the total value of exports. Exports represent over 80 per cent of pulp and paper production and about one-half of lumber production. Slightly less than 90 per cent of the pulp sold is paper pulp and a little over 10 per cent is dissolving pulp.

Favorable economic climate, plentiful raw materials (especially coniferous species) and relatively cheap hydro power and water supply have been important factors. In addition, these commodities have attained their present importance in our export trade through access to the large market in the United

93452–4 2½

States and to the United Kingdom. We have become highly dependent on a few commodities destined for these two markets, as shown in Table 1.

Table 1. Forest Products Exports from Canada, 1960

	To United States	To United Kingdom	To Other Countries	Totals
	— million dollars —			
Newsprint	631	60	67	758
Woodpulp	256	32	37	325
Lumber	260	53	33	346
All other Products	111	35	17	163
Totals	1,258	180	154	1,592

Source: Dominion Bureau of Statistics, *Trade of Canada.*

The total value of exports of forest products in 1960 was $1,592 million, and of this $1,258 million (79 per cent) was shipped to the United States and $180 million (11 per cent) to the United Kingdom. Although shipments to Canada's traditional markets will grow, prospects are that new markets may assume greater relative importance.

Canada's Place in the World Picture

World production of wood pulp in 1959 was 61 million tons, with Canada producing 10.9 million tons or 18 per cent of the total. If only the non-communist countries are considered, Canada's output was 20 per cent of the total of 55.5 million tons. However, this country's share of the non-communist world production declined some four percentage points during the 1950's. Production of wood pulp by area in 1950 and 1959 is shown in Table 2 below.

About 13 per cent of paper pulp production moves between countries with Canada and the Scandinavian countries (Finland, Norway and Sweden) dominating this field, supplying 85 per cent of the total. Of the paper pulp exported, about 25 per cent goes to the United States and more than 60 per cent to Western Europe. In addition, some 16 per cent of the world's production of paper and paperboard enters international trade. Newsprint accounts for nearly 70 per cent of the total, with Canada and Scandinavia supplying nearly 90 per cent of the newsprint exports. The United States imports 45 per cent of the total paper and board traded while Western Europe takes about 30 per cent.

Most of the paper in the world, therefore, is manufactured in the consuming country and most paper is made of domestic pulp. Trade movements are limited and dominated by movements of newsprint and pulp

Table 2. World Production of Wood Pulp

Area	1950	1959	Increase	
			tons	per cent
	— thousand tons —[a]			
Canada	8,473	10,926	2,453	29
United States	14,849	24,257	9,408	63
Western Europe	9,828	15,504	5,676	58
Latin America	264	702	438	166
Asia, Africa and Pacific (of which Japan)	(991)	(4,082)	(3,091)	(312)
All Non-Communist Countries	34,405	55,471	21,066	61
Communist Countries	3,646	5,547	1,901	52
World Total	38,051	61,018	22,967	60

[a] All tonnage figures in this paper are in short tons of 2,000 pounds.

Source: Canadian Pulp and Paper Association, *World Wood Pulp Data 1958–59.*

from Canada to the United States and movement of newsprint, other paper and board, and pulp from Scandinavia to Western Europe.

In lumber production Canada ranks third, with some eight per cent of the world's total. Foreign trade in lumber is important with some 10 per cent of global production exported. Canada is the leading exporter of this commodity, shipping slightly more than the three Nordic countries combined, supplying about one-third of total exports. The United States is the leading importer of lumber with the United Kingdom second.

Other forest products are far less important in world trade and are not considered separately here.

Canadian Prospects in Brief

Newsprint

Growth of newsprint consumption should mean an increase of about 60 per cent in exports within 15 years. Annual Canadian shipments to the United States should then increase by about 2,240,000 tons and overseas exports may double to reach a level of 2,700,000 tons.

Paper (other than newsprint)

World demand for paper is certain to grow. The growth rate in overseas countries will be faster than in North America, but their productive capacity will also grow. Paper (other than newsprint) and paperboard are protected by tariffs in most countries, and Canada's exports of these products are relatively

small. Domestic production will be encouraged in other countries, and there is no immediate prospect of any large increase in sales of these products. On the contrary, Canada will meet increased competition in the next decade in one of her larger markets – the United Kingdom – as tariff levels are reduced in the European Free Trade Area (EFTA). Increased Canadian shipments overseas may, therefore, be confined to pulp.

Pulp

The larger part of any increase in pulp shipments will most likely be to overseas markets. Recent trends in the purchase of pulp by non-integrated paper mills in the United States suggests that this outlet will not grow and any increase in pulp shipments to the United States will be captive pulp.

The best prospects for larger pulp exports are probably in Europe. While consumption in Asia and Latin America will rise steeply, those areas also have abundant wood or non-wood fibre resources which they will make every attempt to use. Recent technological developments permit such materials as bagasse, bamboo and hardwoods to be used for paper making. European consumption of pulp for products other than newsprint is expected to increase by some 8,500,000 tons. Canada now supplies about 400,000 tons of pulp to Europe and two-thirds of this goes to the United Kingdom. Development of markets in Europe would therefore mean supplying areas in which we now sell very little.

Lumber

The prospects for Canadian lumber exports are for a smaller increase than for pulp and paper; a rise of 30 per cent would seem possible. This is based on Canada obtaining a slightly increasing share of a moderate growth in consumption of lumber in the United States, and increased shipments to the United Kingdom. Lumber consumption has risen slowly in recent years and some believe that growth will cease because of substitution of other products. Should this happen, the prospects will be much less favorable.

Other Products:

Pulpwood exports are expected to increase but will not add greatly to the export side of our balance of payments. While opportunities for export of other products may develop, the prospects of this happening are very uncertain.

General

The general picture based on the analysis of the outlook for each of several products as presented in the sections following can be given by the estimated exports as in Table 3.

Table 3. Exports of Major Canadian Forest Products[a]

	1960	1975 (forecast)
Newsprint exports	6,265,000 tons	10,200,000 tons
Pulp exports	2,605,000 tons	4,000,000 tons
Lumber exports	4,574,000 M board feet	6,100,000 M board feet

[a]See Table 14 for total, present and prospective (1975), demands for forest products.

The above quantities, together with the expected increase in forest products consumption in Canada, could be produced with a 55 per cent increase in industrial roundwood consumption.

A word of caution should be given at this time. Additions to European pulp and paper capacity now under way will add more than increased demand will absorb over the next three or four years. The highly competitive conditions now experienced in pulp markets can be expected to continue during this period.

Qualifying Considerations

These forecasts are only judgments based on what are considered to be the most likely developments, and many eventualities could upset them. For example, our knowledge of the forest resources of Europe and their pulpwood supply situation is inadequate to allow us to predict, with any degree of certainty, the volume of pulp and paper products that Canada may expect to export to Europe. European forests have long been under development and one may think that the cut of wood cannot be significantly increased. However, technological developments allow greater use of hardwoods and account for higher pulp yields per unit volume of wood. In addition, intensified forest management increases wood production. These factors will allow a considerable rise in output before wood-supply problems become pressing.

In the world picture, ideas concerning the supply of industrial wood have changed considerably during recent years. Partly because of technological developments which extend the number of usable species and partly because of improved knowledge of forest resources, wood supplies are now considered to be considerably higher than was formerly believed. While Canada has large and valuable supplies of softwood, this must not lead us to believe that the world must come to our door for forest products. Market conditions are expected to be highly competitive.

Trading policies finally adopted by European countries may have a great effect on Canada's exports to

this market. It now appears that exports will be confined to pulp, which will likely enter Europe duty-free, and newsprint, which will be a low-tariff item for countries of the European Economic Community (EEC) – the Common Market. Other papers and boards will have tariffs of about 18 per cent. The adoption of low tariffs on other paper and paperboard products by the EEC could lead to the export of substantial quantities of these products from Canada, but this development appears unlikely. The formation of one trading bloc in Europe could put Canadian industry at a disadvantage compared to the present situation. Tariffs could be applied to all Canadian paper and paperboard while shipments from Scandinavia would enter free of duty. It is conceivable also that a tariff could be applied to pulp from outside countries. These developments could effectively bar increased Canadian shipments to Europe.

A combination of developments could occur which would leave Canada in a far less favorable situation than is assumed in this study. Rapid development of the vast forests of the U.S.S.R. could supply a good part of the world's needs for forest products if that country so wished. European pulp consuming industries may find it advantageous to develop captive sources of supply in dependent overseas territories and could meet a large part of their additional needs from this source. European forests may be able to sustain larger production than we now believe. Certainly past estimates of Europe's wood supplies have been low. United States pulp and paper exports have been growing in recent years and may very well continue to do so. The forests of the United States are adequate to supply all that country's needs for pulp and paper for the foreseeable future – Canada's participation in that market rests on ability to compete effectively. Should the worst possible circumstances develop, they could result in very little growth in exports of Canadian forest products. It cannot be overemphasized that these are forecasts of opportunities, not of sales. To grasp these opportunities Canada must do much more than merely build more manufacturing capacity.

Forecast of World Paper and Paperboard Demand

The uses of paper and paperboard are too well known to need description here. Per capita consumption of paper varies widely throughout the world; in Western Europe it is only one-quarter and in Latin America only one-twentieth of the North American level.

Consumption of newsprint and printing and writing papers is a function of the prevailing level of literacy and per capita income; consumption of sanitary papers is related to income, and that of industrial papers and paperboard to income and industrial production. Paper and paperboard consumption has a moderate growth-rate in advanced economies, and in total is rising only slightly faster than total income. In countries with lower per capita income, consumption is increasing more rapidly, in part because of faster growth in income and in part because of greater rates of increase in consumption in relation to increases in income (the elasticity of demand with respect to income is greater at low than at high levels of income).

The forecast of paper and paperboard consumption used here is that given in the FAO report on *World Demand for Paper to 1975*. This report gives the most complete analysis yet published of paper and paperboard use by economic regions. In brief, the study determined relationships between per capita income and per capita consumption through cross-section statistical analyses of the two variables in groups of countries. These relationships may be applied to particular levels of population and per capita income to estimate consumption. For each region in the forecast, United Nations population estimates and estimated *real* per capita gross national product were used to predict levels of paper and paperboard consumption for 1965 and 1975. The forecasts refer to the population and income levels used, not to the particular years chosen. If economic growth rates are faster or slower than expected the consumption levels will be reached correspondingly sooner or later. Although actual consumption of paper and paperboard in 1965 and 1975 may differ from the FAO estimates they are the most reliable basis for evaluating Canada's future as a supplier of pulp and paper.

The study shows total world demand for paper and paperboard to be increasing at a moderate pace – the annual compound rates being 4.7 per cent for the world as a whole and 4.1 per cent for the non-communist countries. Compared with present levels world consumption will double by 1975 and consumption in non-communist countries will rise about 75 per cent.

The amounts and rates of increase vary widely by region and by product. For the period from 1955 to 1975 by far the largest volume increase is for the United States, accounting for 40 per cent of the estimated increase for the non-communist world. North America and Western Europe together will account for 71 per cent of this increase. The highest proportionate increase is expected in the communist countries at 440 per cent during the 20-year period while the highest rate of any region except the communist Bloc is predicted for the Far East (excluding Mainland China). Paperboard is forecast to have the largest absolute and percentage increase of the four grades covered in the study. The expected changes are summarized in Tables 4 and 5.

Table 4. Increase in Paper and Paperboard Demand by Countries, 1955 to 1975

	Volume Increase (million tons)	Percentage Increase	Compound Rate of Increase (per cent per year)
United States	26.9	82	3.0
Canada	3.0	149	4.7
Latin America	5.2	258	6.6
Western Europe	18.8	130	4.2
Africa	1.2	230	6.1
Near and Middle East	0.4	278	6.9
Far East[a]	12.0	362	7.9
Oceania	1.2	141	4.5
Sub-Total	68.7	123	4.1
Eastern Europe	5.7	273	6.8
U.S.S.R.	10.9	399	8.3
Mainland China	8.8	917	12.3
Sub-Total	25.4	440	8.8
World Total	94.1	152	4.7

[a]Excluding Mainland China.

Source: World Demand for Paper to 1975. (FAO)

Note: Two sets of estimates are given in the FAO study, one prepared by the Secretariat on the basis of statistical analysis and given in Table 2.29 page 51 and the other (some six per cent lower in total) based on Secretariat estimates adjusted for certain regional considerations. The higher estimates are used here.

The tables show clearly the regions in which the greatest increases will occur – United States, Western Europe and the Far East, and the order of increase among the commodity groups – paperboard accounting for the largest increase. The prospects for Canada in these markets is discussed below

Table 5. Increase in Paper and Paperboard Demand by Commodity Groups, 1955 to 1975

	Volume Increase (million tons)	Percentage Increase	Compound Rate of Increase (per cent per year)
Non-Communist World			
Newsprint	13.5	115	3.9
Printing and Writing	11.6	113	3.9
Other Paper	16.8	114	3.9
Paperboard	26.8	138	4.4
Total	68.7	123	4.1
Communist Bloc			
Newsprint	4.1	550	9.8
Printing and Writing	5.7	445	8.8
Other Paper	7.7	332	7.6
Paperboard	7.8	554	9.8
Total	25.4	440	8.8
Total World			
Newsprint	17.6	141	4.6
Printing and Writing	17.3	150	4.7
Other Paper	24.6	144	4.6
Paperboard	34.6	167	5.1
Total World	94.1	152	4.7

Source: World Demand for Paper to 1975. (FAO).

Newsprint

Canada produced 47 per cent of all the world newsprint in 1960, and supplied three-quarters of exports (excluding the communist countries). Newsprint is the one paper commodity which is tariff-free in nearly all countries, and about 55 per cent of the non-communist world demand is met by imports. The United States takes 85 per cent of Canadian exports and hence the future of the Canadian newsprint industry will probably depend very largely on consumption there.

Table 6. Summary of Non-Communist World Trade in Newsprint, 1960

From / To	Canada	Northern Europe[a]	Other	Total World Imports (excluding Communist Countries
	– thousand tons –			
United States	5,260	147	–	5,406
Western Europe	493	715	156	1,364
(of which United Kingdom	(480)	(215)	(1)	(696)
Latin America	234	205	135	574
Australia and New Zealand	163	50	63	276
Other	116	152	208	476
Total World Exports (excluding Communist Countries)	6,265	1,269	562	8,096

[a]Northern Europe refers to Sweden, Norway and Finland.

Note – Totals include a small tonnage of newsprint imported from and exported to Communist countries.

Source – Newsprint Association of Canada.

U.S. Newsprint Demand. There are several recent estimates of future newsprint consumption in the United States. While these estimates differ somewhat, they are in general agreement on the probable magnitude of increased demand over the next 15 years. Consumption is expected to have a steady but moderate rate of growth in that period; the increase being somewhat less than the rise in *real* income. Actual consumption in 1960 was 7,376,000 tons while three forecasts for 1975 published within recent years are the following:

Forecast 1975

1. FAO (1959) 10,700,000 tons
2. U.S. Forest Service (1958)[a] 10,000,000 tons
3. Royal Commission on Canada's Economic Prospects (1957)[b] 9,500,000 tons

[a]*Timber Resources for America's Future.* Forest

Service, U.S. Department of Agriculture. Forest Resource Report No. 14, Washington, D.C. January 1958.

[b]*The Outlook for the Canadian Forest Industries.* Royal Commission on Canada's Economic Prospects. Ottawa, March 1957.

The American Newspaper Publishers Association (A.N.P.A.) has recently published a forecast of 9,740,000 tons for the year 1970. A straight line extrapolation of the FAO estimates for 1965 and 1975 gives an estimate for 1970 of 9,525,000 tons, a difference of about two per cent from the A.N.P.A. figure. The forecast of the Royal Commission on Canada's Economic Prospects now appears to be low, judged by the other studies. Without making a complete evaluation of these forecasts, it would seem reasonable to assume here that U.S. newsprint consumption in 1975 will be about *10,500,000 tons*, an increase of 3,125,000 tons (42 per cent) over the 1960 level. A point of interest is that this increase is at a compound annual rate of 2.4 per cent.

Canada now fills 71 per cent of total U.S. newsprint needs, while 27 per cent comes from U.S. mills and two per cent from overseas countries. The supply pattern has changed considerably in the last ten years. Canada supplied 80 per cent of U.S. requirements in the early 1950's, but in the past decade production of newsprint in the United States has doubled. Technological developments in the use of pine for newsprint made possible greatly increased production in the Southern States. Mills were encouraged by economic considerations, including the ability to serve regional markets at low freight costs.

What share of the U.S. market may Canada expect in the future? First, the United States will likely import only token quantities from overseas countries. There is no reason to expect as large a percentage rise in U.S. production in the next decade as occurred in the 1950's, since the void in the South is now filled. The United States newsprint industry is now operating at 85 per cent capacity. Only two prospective new mills areknown to be definitely planned for that country. However, Canada's competitive position for new mills and new machines is not favorable. In order to hold the present share of the United States market, Canada will have to improve its competitive position. If we are able to do that, shipments to the U.S. in 1975 may be 7,500,000 tons – an increase of 2,240,000 tons (42 per cent) over the 1960 volume.

Newsprint Exports to other Countries. Consumption of newsprint in the non-communist countries (excluding North America) in 1960 was 6.4 million tons, of which 2.7 million tons were imported. Canada and the three northern European countries together supplied 80 per cent of these imports. The FAO study forecast 1975 consumption in these overseas countries to be 13.5 million tons, an increase of 7.1 million tons over current levels.

What are the possibilities for Canadian industry in these overseas markets? Full treatment of this subject would require a complete analysis of the situation in each country, which is not possible here. However, it may be worthwhile to list expected increases in consumption in various regions of the world (excluding communist countries).

Table 7. Newsprint Consumption, Overseas Countries

	1960	1975 Forecast	Increase
	– thousand tons –		
Latin America	720	1,970	1,250
West Europe	4,000	7,180	3,180
Africa	110	380	270
Near and Middle East	40	130	90
Far East	1,150	3,220	2,070
Oceania	420	660	240
	6,440	13,540	7,100

Source: 1960 – Newsprint Association of Canada.
1975 – World Demand for Paper to 1975.

Much of the increase in consumption in these countries will be met by home production. South America and Far Eastern countries are making a drive to increase newsprint production. These two regions have large fibre resources in the form of hardwood forests, bamboo and bagasse which – with technical developments that have taken place – can be used for this purpose. Perhaps the greatest unknown is the availability of capital for mill construction. Newsprint mills cost a great deal and there will be large capital requirements for other industrial projects. It thus may prove more economic for the less developed countries to concentrate their capital expenditures on other industries and rely largely on imports of newsprint for a considerable part of their needs. However, it seems that imports of newsprint by countries in these two areas will not increase significantly during the next 15 years.

Consumption of newsprint in Western Europe is forecast to increase from the 1960 level of 4.0 million tons to 7.2 million tons by 1975. Thus the growth in this region offers an opportunity for a substantial increase in Canadian newsprint exports. Western Europe now has a net export surplus of newsprint, exports from Scandinavia to areas outside Europe being slightly larger than North American exports to Europe. European production is expected to increase in the future and probably will satisfy a considerable proportion of increased requirements.

Increased consumption in Near and Middle East countries and in Africa will depend more on imports

since these regions, except for parts of Africa, lack suitable raw materials for newsprint. The forecast increase in consumption for these two regions is relatively small however, being some 360,000 tons between 1960 and 1975.

Capacity increases in non-communist countries (excluding North America) that have been announced total about 2.0 million tons and will bring capacity in 1965 to 8.1 million tons; consumption also in 1965 is forecast at 8.6 million tons. If all this new capacity is installed overseas countries will be able to meet their newsprint needs without greatly increased shipments from North America.

For the longer term a substantial rise in overseas shipments is likely. The exact pattern cannot be forecast. The increase could take place mostly to Europe, or, on the other hand, Canadian shipments to other overseas countries might replace imports from Europe. The amount of the increase is a matter of judgment, but because Canada has advantages over other areas for newsprint production it would seem reasonable to expect an increase in Canada's share of the total overseas market. Canada's share of this market was 15.6 per cent in 1960. If we are to supply 20 per cent of it by 1975, shipments overseas in that year may be 2.7 million tons. This is lower than the forecast given in *The Outlook for the Canadian Forest Industries* which predicted 1975 overseas shipments at 3.2 million tons. Considering the capacity increases that have been announced recently, the lower figure would seem to be more likely to be attained.

Canadian Demand for Newsprint. Canadian demand for newsprint is expected to show relatively rapid growth, because of growth in population and per capita income (and higher demand elasticity with respect to income than will prevail in the United States). *The Outlook for the Canadian Forest Industries* estimated consumption in 1975 will be 820,000 tons; the FAO study forecast a level of 900,000 tons in that year.

Total Prospective Demand for Canadian Newsprint. The estimates given above are summarized in Table 8. The estimates suggest a possible increase in demand of 65 per cent for Canadian newsprint by 1975.

Table 8. Prospective Demand for Canadian Newsprint

	1960	1975 Forecast
	— thousand tons —	
Shipments to United States	5,260	7,500
Shipments to Overseas Countries	1,005	2,700
Shipments to Canada	490	900
Total	6,755	11,100

Other Paper and Paperboard Products

Exports. Shipments of other paper and paperboard products from Canada in 1960 were an estimated 274,000 tons, very small in relation to the volume of newsprint exports. Canadian shipments are also small in relation to total world imports of this group of products, and presently account for less than ten per cent of imports by non-communist countries. Exports by product group and destination are shown in Table 9.

The above products are protected by tariffs in nearly all markets and it may be expected that most countries will encourage further domestic production. As in the case of newsprint, Latin America and Far East countries have the resources for expanding production of these products, although wood pulp may be imported for part of the furnish. According to the FAO forecasts, consumption in Western Europe should increase by about 11 million tons in the next 15 years. The eventual pattern of trade and production will depend largely on the tariff levels finally adopted by the EEC and EFTA blocs. Presently proposed

Table 9. Exports of Paper and Paperboard (Excluding Newsprint) from Canada, 1960

Destination	Paperboard	Wrapping	Book and Writing	Tissue and Sanitary	Other Paper and Board	Total
	— thousand tons —					
United States	4.7	5.1	44.2	0.0	57.6	111.6
United Kingdom	96.9	22.6	4.6	1.0	2.1	127.2
Other Europe	0.8	0.0	0.7	0.1	1.2	2.8
Latin America	2.5	2.1	6.8	2.5	3.2	17.1
Other Countries	0.7	4.5	5.0	1.3	3.9	15.4
Total	105.7	34.2	61.2	4.9	68.0	274.1

Note: Totals may not add because of rounding.
Source: Dominion Bureau of Statistics, *Trade of Canada.*

outside tariffs by the EEC countries are 18 per cent for these products. Canada will lose tariff advantage in the United Kingdom as present U.K. tariffs on imports from Scandinavia are eliminated by 1970. This will mean much stronger competition in Canada's main market for paper and paperboard. The joining of the EEC and the EFTA, with Canada an *outside* country (a definite possibility) would not only reduce Canada's present advantage in the United Kingdom but result in Canada being at a tariff disadvantage in the European market compared with Scandinavian suppliers. If Canadian exports to Europe are going to increase they are more likely to be in the form of pulp than paper and paperboard.

Canadian exports to the United States are chiefly duty-drawback items such as paper used in magazines that are exported to Canada. This field offers no opportunities for any large tonnage expansion.

Current expansion plans for paper and paperboard mills in non-communist overseas countries will bring capacity to 30.7 million tons, while the forecast demand for 1965 is 28.9 million tons. Thus, the immediate prospects for increased exports of paper and board products are not encouraging. For the longer term, the abundance of wood in Canada relative to other countries suggests that opportunities for increased exports will develop. It is an open question whether shipments will be made as pulp or as paper and board. The two groups of products are closely related – greater shipments of paper could mean smaller shipments of pulp.

It would seem economically advantageous to produce some types of paper in Canada for export. Products such as wrapping paper and container-board which can be standardized could be made cheaper in large-scale production in long runs. Fine papers, however, are market-oriented and since they embrace many types and grades, manufacturing them for export raises inventory and service problems. Canada can expect strong competition from United States producers in overseas markets. With large mills designed for the vast United States market and cheaper wood than is available in Canada (at least in the South and on the West Coast), the United States industry can accept lower returns than the Canadian industry. United States exports of paper and paperboard in 1960 were 1.0 million tons, nearly seven times as large as Canadian exports overseas (not including newsprint).

Because of the many unknowns, any forecast of exports of paper other than newsprint and paperboard would be a pure guess. It is better not to make a specific forecast for this group but to confine predictions to pulp with the understanding that part of the tonnage may be shipped as paper and paperboard.

Table 10. Paper and Paperboard Demand in Canada

	Domestic Shipments 1960	Demand Forecast 1975
	— thousand tons —	
Printing and writing	300	660
Other papers	520	1,100
Paperboard	870	2,340
Total	1,690	4,100

Source: 1960 — Canadian Pulp and Paper Association.
1975 — World Demand for Paper to 1975.

Canadian Consumption. Domestic demand for paper (excluding newsprint) and paperboard now totals 1.81 million tons a year, including imports of about 120,000 tons. Consumption is expected to increase at a more rapid rate than in the United States, in part because of a higher rate of population growth and in part because of a higher growth rate in per capita income. Per capita consumption of paper and paperboard in Canada is now about two-thirds the level of the United States. The forecast used here (Table 10), given in *World Demand for Paper to 1975* implies per capita consumption reaching the present United States level before 1970.

Exports of Pulp

World imports (excluding communist countries) of pulp in 1959 were 8.7 million tons. Canada supplied about 2.45 million tons or nearly 30 per cent of the total. The United States was Canada's largest market and accounted for five-sixths of our exports. The United States and the United Kingdom are the two largest importers of pulp, each taking about 2.5 million tons a year for a total of nearly 60 per cent of these imports. The three Northern European countries exported 5.3 million tons of pulp in 1959 (of which 0.2 million tons went to communist countries), most of it to other European countries.

In examining the prospects for future Canadian shipments to the United States, several important points must be carefully weighed.

1. Canada's exports of pulp to the United States in 1959 were more than three times their level just before World War II but have not increased appreciably in the past five years.
2. There has been no increase in total United States imports of pulp from the level reached before World War II. Canada's increased exports to the U.S.A. have replaced shipments from Europe. Canada now supplies about 81 per cent of U.S. imports so that little further growth by substitution can be expected.
3. An important recent development in the United States paper industry has been the integration of

pulp and paper production and the relative decline of pulp purchases. This trend is expected to continue.

4. The forest resources of the United States are probably adequate to supply the pulp requirements of the country for the foreseeable future. Technological developments which enable the use of hardwoods for many grades and high-yield pulping systems which reduce wood requirements per ton of output for some products reinforce this expectation. Indeed, United States exports of pulp have increased sharply in the past decade, and according to available preliminary data totaled 1.1 million tons in 1960.

Some 40 per cent of Canadian pulp shipments to the United States (about 830,000 tons) are *tied*, the remainder being free market pulp. It is the present concensus that market pulp will be at best static and may decline in volume. Increased pulp exports to the United States therefore will depend on shipments from American-owned or controlled mills in Canada to the owner's paper plant in the United States. If these *tied* shipments increas at the same rate as the expected rate of increase of United States paper production, they will increase by about 500,000 tons by 1975 and bring total Canadian pulp exports to the United States to 2.5 million tons.

As for other areas of the world, Asian countries will be working toward self-sufficiency in pulp supply. As previously mentioned they might meet their fibre requirements from a variety of raw materials, but they may need wood pulp imports to supplement pulp made from other materials. It is also possible that the growth in consumption will outstrip their ability to supply, but we do not know enough about production potential in this area to forecast objectively the trend of our pulp exports to that market.

While complete figures for 1960 are not available at the time of writing, important changes occurred during the year which are brought out by preliminary estimates given in Table 12 which shows the increase in pulp shipments in 1960 over 1959 from the three main exporting areas.

Table 12. Increase in Pulp Shipments, 1960 over 1959

From \ To	Canada	United States	Northern Europe
	— thousand tons —		
United States	40	—	0
United Kingdom	70	140	100
Other Western Europe	40	160	250
All other countries	—	200	-80
Total	150	500	270

Source: Canadian Pulp and Paper Association.

In Latin America self sufficiency in pulp supply will also be a dominant force there. Opportunities for larger exports to some countries may exist but, on the whole, it seems unwise to count on any large increase in shipments to the area.

Table 11. Trade Flows of Wood Pulp, 1959

From \ To	Canada	United States	Sweden	Norway	Finland	Other	Total World Imports (excluding Communist Countries)
	— thousand tons —						
United States	1,966	—	278	32	127	—	2,431
United Kingdom	217	161	924	458	517	—	2,495
Other Western Europe	80	229	1,425	249	577	—	2,849
Latin America	64	113	126	19	165	—	488
Far East	107	80	49	5	24	—	270
Australia and New Zealand	13	12	58	4	25	—	150
Exports to other Non-Communist Countries and Not specified	3	57	34	2	7	—	(113)
Imports of other countries							46
Total Exports to Non-Communist Countries	2,450	652	2,923	768	1,443	493	8,729

Note: The figures of this table do not add up exactly to the given totals because:

(a) some exports go to Communist countries and is impossible to separate them and

(b) the destination of some exports is not specified and these may therefore appear twice in the Table.

These errors are small, and the main trade flows are clearly indicated by the table.

Source: United States Pulp Producers Association, *Wood Pulp Statistics*, 25th Edition, 1960.

Europe as a whole is a net exporter of pulp, but it is also the largest importing region in the world; the export trade is largely from Northern European countries to the pulp-deficient countries to the west and south. Pulp requirements for all paper products in 1975 are expected to be 27.0 million tons compared with 15.2 million tons in 1959, an increase of 11.8 million tons. Newsprint expansion will absorb 3.2 million tons of this increase leaving 8.6 million tons for other grades of paper and board. Part of this increase can be supplied from European production because larger wood harvests are practicable. Too little is known about future wood supplies however to state confidently what Europe's import needs might be. The Food and Agriculture Organization has made only guarded statements on this subject, predicting that the industrial wood supply in Western Europe will increase by ten per cent through the present decade (World Demand for Paper to 1975 p. 126). The Final Report of the Tenth Session of the European Forestry Commission stated the belief that there are possibilities of Europe meeting its roundwood needs in 1970, provided prices prove remunerative (World Demand for Paper to 1975, p. 127). Expansion of European pulp production is expected to add 5.2 million tons to pulp capacity over the 1958 level and bring the total to 21.3 million tons by 1965 while pulp requirements are forecast to be 19.0 million tons. It would appear therefore that Europe may be able to meet her pulp requirement over the short term but in the longer term may have to import substantial amounts.

The market pulp business is highly competitive at the present time and there has been general weakness of prices for several years. In view of the large capacity increases planned for Europe this situation may very well continue for some time.

Future Canadian pulp exports will depend largely on the net balance between production and consumption in Europe. Here an important unknown factor is the possibility of exports from the U.S.S.R. The vast resources of that country are sufficient to meet the entire prospective increase in Europe as well as satisfy home needs but we cannot know if the U.S.S.R. will invest enough in the pulp and paper industry to permit large exports. It is quite possible that other areas of the World, Africa for instance, may be drawn on to supply part of Europe's needs through establishment of pulp mills by European paper manufacturers. Developments have already occurred along these lines. It is also possible that United States pulp exports will increase.

An increase in pulp shipments to Europe may well depend on the development of captive sources of supply similar to arrangements that have been made by United States manufacturers. This possibility together with the comments made previously about pulp shipments to the United States has obvious implications for Canadian commercial policy.

Dissolving pulp can not be given separate analysis here but should at least be mentioned. Exports of this product were 275,000 tons in 1960, mostly to the United States. Canadian shipments have declined in recent years, largely as a result of increased competition from large mills built in the United States. Consumption of dissolving pulp in the United States is under threat of decrease with the possibility of viscose tire cord being displaced by other fibres. If this should occur it would reduce consumption by about 275,000 tons and add this amount to paper pulp supply. Canada can not expect any increase in dissolving pulp exports in the near term.

The short term prospects for pulp exports are not encouraging. However, the longer term potential is large and if Canada is able to compete effectively in quality, service and price, exports of pulp could increase from the present level of 2.6 million tons to 4.0 million tons or more but we cannot be at all sure of reaching such a level.

Outlook for the Lumber Industry

Exports of Lumber

The Canadian lumber industry uses about one-half of the wood cut from the forests. Roughly half of the lumber produced is exported, and the annual value of exports has recently been about $300 million. Over 80 per cent of the exports are to the United States.

Table 13. Canadian Lumber Production and Trade

	1959	1960 estimated
	— million board feet —	
Production	7,301	7,720
Exports	4,170	4,575
to United States	3,520	3,485
United Kingdom	346	670
Other countries	304	420
Imports	309	300
Apparent Consumption	3,440	3,445

Source: Canada, Dominion Bureau of Statistics, *Trade of Canada.* "Production, Shipments and Stocks on Hand of Sawmills".

Future lumber exports will probably depend on the trend of shipments to the United States and the United Kingdom. Exports to other countries are relatively small, and there is no indication at present that they will increase significantly.

United States lumber consumption in 1959 was 39.8 billion board feet, of which 4.1 billion was imported.

Consumption there has shown no increase in the past decade and there is some disagreement as to the future level of consumption. Some expect no increase or that an absolute decline will occur. However, in view of the growth of the United States economy this would imply a substantial deterioration of the competitive position of lumber. A more realistic view is that lumber consumption will increase slightly. The United States Forest Service estimated that consumption in 1975 will be 47.6 billion board feet (the so-called lower level of demand) – an increase of 20 per cent over the present level.

Canada may be able to supply an increasing proportion of United States needs if our quality standards are maintained. The supply of saw timber in the United States is limited, and increased lumber production there will likely involve higher costs. The Royal Commission on Canada's Economic Prospects (often referred to as the Gordon Commission) estimated that Canada could supply ten per cent of U.S. consumption in the future and should this occur, exports in 1975 would be 4.7 billion board feet.

Exports to the United Kingdom have varied widely in recent years but have been on a downward trend during the past decade. In 1959 Canada supplied 12 per cent of U.K. imports compared to one-quarter ten years ago. Increased shipments from Finland and the U.S.S.R. have displaced Canadian lumber. Canadian shipments turned sharply upward recently, and, in 1960 were the highest in the past five years.

For the longer term it is expected that exports to the United Kingdom will increase. A big question mark is the offerings of the U.S.S.R. which could, on the basis of its forest resources, be greatly increased. The Gordon Commission forecast exports of lumber to the United Kingdom to be 1,000 million board feet in 1980 and this still seems to be a reasonable prediction. Assuming a gradual growth to this level, exports in 1975 could be about 900 million board feet.

Lumber imports by countries of Continental Europe are slightly larger than those of the United Kingdom but Canada has supplied only token amounts to that market. Exporting countries of eastern and northern Europe meet their import requirements. Development of that market by Canada would mean a significant increase in lumber exports. While this is a possibility, we can not count on it at this time. Exports to all countries other than the United States and United Kingdom increased in 1960 and it is assumed that a further small increase will occur to bring the level to 500 million board feet by 1975.

Lumber Consumption in Canada

Lumber consumption in Canada has not increased in the past decade despite growth in the domestic economy. Lumber has been losing place to plywood, fibre building boards and other materials for many years. An estimate made for the Gordon Commission forecast lumber use in Canada in 1980 would increase to 5.8 billion board feet after allowing for a decrease in per capita consumption of 14 per cent. Recent trends now indicate this estimate to be too high. While a sharp increase in house building and other construction might result in such a level, a lower estimate seems more realistic. Assuming that losses to other materials will account for a further 10 per cent drop in per capita consumption from the level used in the earlier study the domestic demand would be about 4.8 billion board feet in 1975. Lumber imports are assumed not to change.

The total domestic and export demands suggested here would, by 1975, require production of 10.6 billion board feet.

Exports of Other Forest Products

Pulpwood is the only other forest product exported in significant volume. Shipments in 1960 were 1.1 million cords, but were double this amount in the years 1950-1954. The value of pulpwood exports in 1960 was $25.8 million; pulpwood chips valued at $5.3 million were also exported. United States and overseas demands indicate a future level of pulpwood exports of about 1,750,000 cords as estimated by the Gordon Commission.

It is doubtful whether exports of other forest products will materially increase. Canadian fibre building boards must enter the United States over a tariff. In Europe they must compete with low cost European boards made from a variety of raw materials. Softwood plywood shipments to the United Kingdom have shown an increase of 40 per cent in 1960 to reach a value of $10.4 million and that market may develop further. The use of this versatile material in Europe to a degree approaching its use in North America would mean a very large market. However, since it must compete with low cost hardboards and particle boards produced in Europe, we cannot count on a significant increase. Hardwood veneer exports, mostly to the United States, were valued at $16.5 million in 1960. A growing market for this material may be expected but, according to present information, supplies of veneer quality birch timber are not adequate to support greatly expanded production. Exports of shingles in 1960 were valued at $20.6 million. The market for shingles has decreased from its former level and we have no reason to expect a large increase in exports.

Many other miscellaneous forest products – poles, piling, posts, Christmas trees, etc. – are produced

Table 14. Recapitulation of Prospective Demand

Pulp and Paper		1960	1975 Forecast	Wood Requirements Million Cubic Feet	
Newsprint					
Exports to United States	Million tons	5,260	7,500		
Overseas Shipments	"	1,000	2,700		
Domestic Demand	"	490	900		
Total		6,750	11,100		
Other Paper and Paperboard	"	1,975	4,400		
Exports	"	275	300		
Domestic Demand	"	1,700	4,100		
Wood Pulp Exports	"	2,600	4,000		
Total Exports	"	9,135	14,500		
Total		11,325	19,500	1,300	2,240
Lumber					
Exports	Billion bd. ft.				
United States	"	3.48	4.70		
United Kingdom	"	.67	.90		
Other	"	.42	.50		
Domestic Shipments	"	3.15	4.50		
Production	"	7.72	10.60	1,425	2,000
Plywood — Domestic and Export	Million sq. ft.	1,650	3,000	95	180
Pulpwood Exports	Million cords	1,100	1,750	95	150
Miscellaneous Roundwood Products Exported and Consumed in Canada				80	80
Total				2,995	4,650

for domestic use and export. In total they do not require enough timber to make significant demands on Canadian forest resources and therefore a separate analysis has not been made. For this group, the forecasts given in The Outlook for the Canadian Forest Industries are used in Table 14.

Recapitulation

The foregoing estimates are mainly judgments and many eventualities may affect actual performance. To be realistic the appraisal should, perhaps, establish ranges for the various products. Nevertheless, one estimate, based on the most likely situation that will be facing Canadian industry, has been made for each product or group of products. (See Table 14).

The totals suggest an increase of 59 per cent in the tonnage of pulp and paper exports and one-third increase in lumber exports. The total demand will require 4,650 million cubic feet of timber (using present conversion factors) compared to present requirements of 3,000 million cubic feet. There will likely be a trend toward lower wood use per unit of end-product, as higher yields are possible and a greater part of the pulpwood supply will be met by sawmill residues. To the extent that these developments take place, the amount of round wood required will be correspondingly less.

Future markets for forest products are expected to be large, growing and highly competitive. While the longer-term possibilities are promising, the short-term outlook – the next three to five years – is not so favorable. Excess pulp capacity is expected during this period. Prices of pulp are now depressed. Profitable development of overseas markets will require more favorable prices or, on the other hand, lower costs in Canada. There is an implicit assumption in this study that prices will be at levels profitable for Canadian industry. However, we must also guard against taking action on short-term problems that could restrict our longer-term prospects.

The eventual outcome will be greatly affected by Canadian industry's performance and by government policy. Vigorous development of overseas markets by Canadian industry will be required if exports are to be expanded. Any handicaps placed on Canadian industry by governmental policies, which would reduce

its ability to compete, could prevent the attainment of the projected estimates. In fact, realization will require greater co-ordinated effort on the part of all eleven governments, and of governments with industry, labor and other interested groups. These efforts should be directed to the fields of forest policy, commercial and financial policy, and research in both the physical and social science aspects.

Bibliography

1. Anonymous. Paper Industry's Importance to Finnish Economy. Svensk Pappersmasse-Tidning. November 1960. p. 1118.

2. Anonymous. Swedish Pulp Industry Growth, A Forecast of, Svensk Pappermasse-Tidning. November 1960. p. 1065.

3. American Newspaper Publishers Association, Newsprint for 1970, New York. November 1960.

4. American Paper and Pulp Association, Monthly Statistical Summary. January 1961. Vol. 39, No. 1.

5. Canada. Royal Commission on Canada's Economic Prospects. The Outlook for the Canadian Forest Industries. Ottawa. 1957.

6. Canada. Dominion Bureau of Statistics. Canadian Forestry Statistics, 1959. Ottawa. 1960.

7. Canada. Dominion Bureau of Statistics. The Pulp and Paper Industry, 1958. Ottawa. 1960.

8. Canada. Dominion Bureau of Statistics. Trade of Canada, Monthly and Annual Reports.

9. Canadian Pulp and Paper Association, United States Pulp Producers Association, Inc. World Wood Pulp Data, 1958-1959. Montreal. 1960.

10. Canadian Pulp and Paper Association. Reference Tables 1960. Montreal. 1960.

11. Holland, I.I. An Explanation of Changing Lumber Consumption and Price. Forest Science, Vol. 6, No. 2. July 1960.

12. Newsprint Association of Canada. Newsprint Data: 1960. Montreal. 1960.

13. Streyffert, Thorsten. World Timber – Trends and Prospects. Almquist and Wiksell, Stockholm. 1958. pp. 246.

14. United Nations. Food and Agriculture Organization. World Demand for Paper to 1975. Rome. 1960. pp. XII + 159.

15. United Nations. Economic Commission for Asia and the Far East/ Food and Agriculture Organization. Joint Report of Conference on Pulp and Paper Development in Asia and the Far East. ECAFE/ BTAO/FAO Conf./Report October 29, 1960.

16. United States. Department of Agriculture, Forest Service. Timber Resources for America's Future. Forest Resource Report No. 14 Washington, D.C. 1958.

17. United States Pulp Producers Association, Inc. Wood Pulp Statistics. 25th. ed., New York. August 1960.

Potentialities Of The Forest Resource Base

D.V. Love,
Associate Professor,
Faculty of Forestry,
University of Toronto,
Toronto, Ontario.

The present situation in Canada respecting the availability of wood and its utilization is one of serious imbalance. It is estimated that the 611 million acres of productive forest land in Canada with its present growing stock of 685 billion cubic feet of timber (1,120 cubic feet per acre average) will produce an annual net cut of 12.2 billion cubic feet (19.9 cubic feet per acre). This estimate of annual cut allows for some liquidation of the accumulated growing stock, but presumes a low level of management of cutover lands. The natural productivity[a] of the productive forest land has been estimated at 11.9 billion cubic feet (19.5 cubic feet per acre) per year. This may be considered as the productive capacity of the land under an extensive system of management which will produce well stocked stands and provide for their utilization at maturity.

Present annual utilization of timber in Canada is 2.9 billion cubic feet of industrial wood and 0.3 billion cubic feet of non-industrial wood; thus the potential of the land under an extensive but constant system of management is about four times present utilization.

Despite the tremendous annually available surplus of timber, the increase in wood utilization in Canada for both lumber and wood pulp is considerably less than the world average.

This lack of impetus on the part of Canadian industry undoubtedly results from many factors including, primarily, the fact that Canada is trying to support a high-cost economy. In products of international trade such as lumber, pulp and paper, the high costs of Canadian production are particularly discouraging to expansion. It is not for this paper to discuss the influence which sustained high demands for wages, taxes and profits have on the expansion of Canadian forest industries. The resource manager must do his utmost to obtain a favorable economic environment, but his first responsibility is to produce the best of which the resources are capable within the situation prescribed by the national economy.

In the past there was a lack of concern for the growing of high-quality wood products on accessible forest land from which superior products had been taken. The result is that excessive charges for transportation and transportation facilities must now be incurred to obtain the kinds of forest products which can compete in today's market. Previously other countries with less forest land have learned how to grow wood at competitive prices on accessible lands, thereby providing economical raw material for the expansion of industry. In this country, the policy of lengthening supply routes must lead to ever-increasing raw material costs which tend to weaken our competitive trading position.

Canada contains 142 million acres of land on which it is believed that intensive forestry, i.e. a high investment in labor and capital per unit area, can contribute to the national economy to a limited direct extent in returns on investment and to a very considerable indirect extent through the encouragement of industrial expansion in the wood-using industries.

At present, investments in the forest designed to improve the yield of the forest are largely limited to the construction of roads, the protection of the timber from fire and the measurement of the forest for purposes of planning. None of these operations contributes directly to the production of cheaper, better quality wood for the expansion of industry. The trends of development in world demand for wood indicate that, as with certain Canadian foods, an abundant supply has little appeal for the potential buyer unless it can be provided at prices which he is prepared to pay. The development of Canada's forest resources must aim at the production of the best quality at the lowest cost. We may then sincerely hope that some of the savings resulting from wise use will foster lower prices and expanded utilization.

93452—43

The Physical and Economic Dimensions of the Forest Potential

The present situation in Canada respecting the availability of wood and its utilization is one of serious imbalance. On a national basis it has been estimated (10) (Table 1) that there are 9.4 billion cubic feet of allowable annual cut available on the accessible forest lands and, of this volume 2.9 billion cubic feet are utilized annually for *industrial* purposes and 0.3 billion cubic feet for *non-industrial* purposes (8). The potentially accessible land can provide an additional allowable annual cut of 1.5 billion cubic feet, no part of which is presently being used. The present allowable cut is therefore more than 3.5 times the present utilization.

This gross appraisal disguises certain local situations in which the problem is that of inadequate timber supplies. This inadequacy normally results from the exhaustion of a particular species or of a certain quality of timber from the land adjacent to the plant,

Table 1. Allowable Annual Cut for 1956 Adjusted to the 1959 Inventory

Area	Allowable Cut 1956 (10)						Allowable Cut 1959		
	Softwood		Hardwood		Total				
	Volume	Percentage of Inventory Volume	Volume	Percentage of Inventory Volume	Volume	Percentage of Inventory Volume	Softwood Volume	Hardwood Volume	Total Volume
	(Volumes in Millions of Cubic Feet)								
Accessible Forest									
Newfoundland	123	1.88	8	2.93	131	1.92	249	18	267
Prince Edward Island	8	4.55	3	4.00	11	4.38	5	2	7
Nova Scotia	136	2.50	34	2.50	170	2.50	162	83	245
New Brunswick	300	3.51	150	3.80	450	3.60	419	187	606
Atlantic Group	567	2.74	195	3.44	762	2.89	835	290	1,125
Quebec	995	2.00	332	2.00	1,327	2.00	870	345	1,215
Ontario	783	1.44	671	3.20	1,454	1.72	736	740	1,476
Central Group	1,778	1.70	1,003	2.13	2,781	1.84	1,606	1,085	2,691
Manitoba	100	2.00	73	2.98	173	2.33	114	75	189
Saskatchewan	134	2.46	169	2.54	303	2.50	152	194	346
Alberta	450	2.00	411	2.47	861	2.20	574	575	1,149
Yukon Territory	50	2.02	11	1.97	61	2.01	52	12	64
Northwest Territories	63	2.01	32	2.00	95	2.00	69	39	108
Prairies and North Group	797	2.07	696	2.49	1,493	2.25	961	895	1,856
British Columbia, coast	641	1.40	9	2.58	650	1.41	1,211	15	1,226
British Columbia, interior	706	1.10	32	2.50	738	1.13	2,469	31	2,500
British Columbia (total)	1,347	1.22	41	2.52	1,388	1.24	3,680	46	3,726
Canada (grand total)	4,489	1.64	1,935	2.35	6,424	1.81	7,082	2,316	9,398
Potentially Accessible Forest	1,758	1.44	439	2.91	2,197	1.51	1,245	282	1,527
All Productive Forest Land	6,247		2,374		8,621		8,327	2,598	10,925

and markets may be such for the timber that is available as to make uneconomic the plant modifications required to utilize such timber.

The general lack of utilization of the allowable cut, as indicated above, means that the physical productive capacity of the land is not used. Whether or not this under-use represents an economic waste as well as a physical waste is not easily resolved.

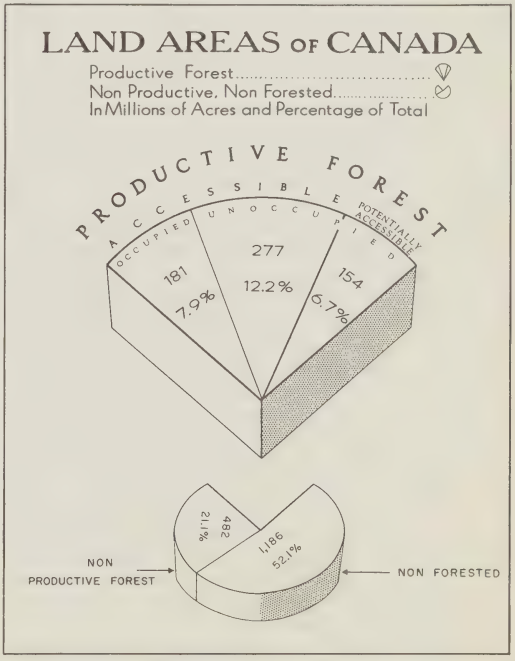
The fuller use of the productive capacity of Canadian forest land is, in the broad sense, clearly a problem of marketing. Forest products are items of international trade, especially for Canada. In the long run, the potential of the Canadian forest will be used only to the extent that it competes with costs for growing timber elsewhere in the world. In this competition, the geographic location of the land relative to markets, the ability of the land to grow wood, and the present timber growing stock on the land are the primary factors about which we can do little; they are especially *fixed* by nature. However, the variable factors which are assuming an ever-increasing importance in limiting the realization of the potential are the demands for returns from the forest by labor, government and investors in the form of wages, taxes and profits. Since the realization of the potential of the land will largely depend on the investment made in the land directly or indirectly by the owners or users of the resource or both, it is an aspect of the problem which cannot be ignored. While this paper is concerned with the potential of the land – the concept of the *potential* in much more than the physical – it must realistically be conditioned by a concept of *management* in tune with open projected competitive position.

Land and Timber Inventories

The total land area of Canada is 2,279 million acres (8) (3.56 million square miles) of which the productive forest area comprises 611 million acres or about 27 per cent of the total. The remaining area is made up of non-productive forested land, 482 million acres (21 per cent) and non-forested land, 1,186 million acres (52 per cent). The latter consists mainly of open tundra and non-productive swamp. From the standpoint of timber production for the foreseeable future, only the productive forest land is of significance. In time, steps may have to be taken to place some of the non-productive land into the productive category, but this is not a problem of concern today.

The productive forest land is further subdivided into *accessible,* 457 million acres or 75 per cent of the total productive area, and *potentially accessible,* 154 million acres or 25 per cent. Accessible land is that which is now suitable for economic exploitation as a source of usable timber. This definition is not absolute and in fact is interpreted differently in different provinces. The distinction between accessible and inaccessible must be considered as an extremely general classification[b].

The productive forest land can also be classified as *occupied,* i.e. privately owned lands or lands held under leases, licenses or permits from federal or provincial governments, comprising 181 million acres or 29 per cent of the productive forest land and *unoccupied* comprising the remaining 430 million acres. The occupation of the land is primarily for the production



of timber and is therefore virtually all within the area classified as accessible. The unoccupied accessible land represents an area of 276 million acres and with the present exception of National Parks (19 million acres), is presumably available for immediate exploitation.

The total volume of timber on the accessible forest land is 475 billion cubic feet of softwood and 114 billion cubic feet of hardwood. On the inaccessible (i. e. potentially accessible) area the softwood and hard-

wood volumes are 87 billion cubic feet and 10 billion cubic feet respectively. The total volume for the entire productive forest area is estimated as 685 billion cubic feet of which 82 per cent is softwood.

The productive forest land and its timber growing stock represent the *factory* which constantly produces the wood available to industry. The extent to which the growing stock is properly distributed by age classes and density over the productive area and is marketed at maturity determines the extent to which the potential of the *factory* can be used. Industry and its wood-producing *factory* must be in balance so that on the one hand the wood does not accumulate as mature and overmature trees, or alternatively so that immature trees do not have to be sacrificed to keep the industry supplied with raw material.

For long-term continuous production the manufacturing plant must be in balance with the growth capacity of the land appropriated for its use. In the short run, an irregular age-class distribution may provide an allowable cut greater or less than the productive capacity of the site depending on the excess or deficiency of mature timber.

Although inventories can make no direct contribution to the quality or quantity of wood produced, they are of considerable importance in planning the most effective use of that portion of the productive capacity of the land which can be recovered under existing political and economic circumstances. Firstly, they determine whether profitable harvesting is practicable, i.e. whether there is sufficient accumulation of the annual growth to permit commercial cutting. Secondly, they indicate the current limitations on the productive capacity of the land imposed by the growing stock, by showing the actual distribution of age classes of timber relative to the perfect distribution in which all age-classes occupy equal areas. Thirdly, as a basic component of many techniques used to determine the allowable cut for a forest area, an inventory may exercise an important regulatory influence on harvesting operations.

Detailed inventories are required for planning logging operations on lands which will be cut over in the near future, but precise data are not needed for broad management planning. The allowable cut, determined in part from inventory data, is applied for the period of the management plan only (usually from 10 to 20 years), after which it is amended to suit the then prevailing forest and market conditions. In the initial stages of management the inventory volume will decrease as the large areas of mature and overmature timber, which normally prevail in the early stages of forest management, are liquidated. Provided adequate regeneration of desirable species is obtained after cutting, such a reduction in mature volume means a better arrangement of age classes of timber growing stock and a better recovery of the growth potential of the land. For the sake of balancing age classes, it may be necessary to defer short-term income from the forest asset. This can be considered, in effect, a form of investment designed to improve the growing stock and its rate of growth in order to reap a higher income at a later date.

To better assess the present situation with respect to growing stock and allowable cut, a number of provinces have been preparing up-to-date inventories. By March 31, 1958, these provinces completed the initial task, and all except Nova Scotia have embarked on a programme of inventory maintenance. With the exception of Saskatchewan, New Brunswick and Nova Scotia the provinces are collecting more detailed information with the object of providing data applicable to forest management on an individual-management-unit basis.

The results of these inventories compared to those provided by the various provinces in 1956 to the Gordon Commission (10) are presented in Table 2. The 1959 inventory[c] shows an increase of timber volume for Canada of almost 40 per cent over the earlier estimate. Since much of the information, even in the 1959 inventory, was based on aerial reconnaissance, there is no doubt that further corrections will be made. However, the current estimate for the accessible area will probably not be grossly altered, unless fire, insects or disease epidemics cause major losses.

Allowable Cut and Natural Productivity

Because inventory volume is a major determinant of allowable cut, the increase in inventory will cause an increase in the allowable cut as determined in 1956. Precise details of the methods used by different provinces for calculating allowable cut are not available. In fact many different methods may be used in any given province depending on forest conditions and the data collected. Hence a recalculation of the allowable cut for 1959, using the same methods as those used in 1956, was not possible. However, one very reasonable method of determining the allowable cut is to assume that it represents a definite proportion of the inventory[d]. Accordingly, the allowable cuts for 1959 shown in Table 1 are those given for 1956 (10) after adjustments proportional to the corresponding changes in inventory figures.

It is noteworthy that, based on the 1956 data, the allowable cut as a percentage of inventory volume ra-

Table 2. Comparison of Inventories of 1956 and 1959

Volumes in Millions of Cubic Feet

Province	Softwood						Hardwood						Total					
	Accessible		Potentially Accessible		Total		Accessible		Potentially Accessible		Total		Accessible		Potentially Accessible		Total	
	1956	1959	1956	1959	1956	1959	1956	1959	1956	1959	1956	1959	1956	1959	1959	1959	1956	1959
Newfoundland	6,549	13,244	7,153	787	13,702	14,031	273	599	72	26	345	625	6,822	13,843	7,225	813	14,047	14,656
Prince Edward Is.	176	100	-	-	176	100	75	48	-	-	75	48	251	148	-	-	251	148
Nova Scotia	5,440	6,470	-	-	5,440	6,470	1,360	3,312	-	-	1,360	3,312	6,800	9,782	-	-	6,800	9,782
New Brunswick	8,550	11,947	-	-	8,550	11,947	3,950	4,921	-	-	3,950	4,921	12,500	16,868	-	-	12,500	16,868
Atlantic Group	20,715	31,761	7,153	787	27,868	32,548	5,658	8,880	72	26	5,730	8,906	26,373	40,641	7,225	813	33,598	41,454
Quebec	49,779	43,540	19,586	-	69,365	43,540	16,593	17,283	2,430	-	19,023	17,283	66,372	60,823	22,016	-	88,388	60,283
Ontario	54,341	51,167	22,414	12,543	76,755	63,710	30,490	33,600	5,603	2,743	36,093	36,343	84,831	84,767	28,017	15,286	112,848	100,053
Central Group	104,120	94,707	42,000	12,543	146,120	107,250	47,083	50,883	8,033	2,743	55,116	53,626	151,203	145,590	50,033	15,286	201,236	160,876
Manitoba	4,990	5,707	1,901	1,901	6,891	7,608	2,445	2,511	205	205	2,650	2,716	7,435	8,218	2,106	2,106	9,541	10,324
Saskatchewan	5,446	6,189	3,500	4,269	8,946	10,458	6,664	7,628	1,717	2,075	8,381	9,703	12,110	13,817	5,217	6,344	17,327	20,161
Alberta	22,496	28,689	8,549	331	31,045	29,020	16,677	23,361	8,129	69	24,806	23,430	39,173	52,050	16,678	400	55,851	52,450
Northwest Terr.	3,132	3,460	6,537	6,660	9,669	10,120	1,603	1,932	1,869	1,977	3,429	3,909	4,735	5,392	8,363	8,637	13,098	14,029
Yukon Terr.	3,475	2,567	4,750	4,819	7,225	7,386	560	606	1,110	1,164	1,670	1,170	3,035	3,173	5,860	5,983	8,895	9,156
Prairie & North Group	39,539	46,612	25,237	17,980	63,776	64,592	27,949	36,038	12,987	5,490	40,936	41,528	66,488	82,650	38,224	23,435	104,712	106,120
British Columbia Total	110,003	301,874	47,429	55,258	157,432	357,132	1,627	18,352	698	1,435	2,325	19,787	111,630	320,226	48,127	56,693	159,757	376,919
CANADA	273,377	474,954	121,819	86,568	395,196	561,522	82,317	114,103	21,790	9,694	104,107	123,847	355,694	589,107	143,609	96,227	499,303	685,369

nges from a low of 1.10 in the B.C. Interior to a high of 4.55 in P.E.I. As already mentioned, an ideal distribution of age classes produces the highest ratio of sustainable allowable cut to growing stock. Where mature timber is being liquidated under an allowable cut which will be reduced following the liquidation period, the ratio of allowable cut to inventory may be very high for a short period. The allowable cut calculations for the provinces are generally quite conservative and do not contain any provision for a serious reduction in cut at a later stage. The percentage figures contained under "Allowable Cut 1956" in Table 1 therefore indicate in a very rough way the degree of normality of the age-class distribution in the growing stock. Ratios of less than two per cent suggest an unfavorable distribution of age classes or a very conservative allowable cut with no provision for the accelerated removal of the overmature and mature timber, or both. The over-all ratio of 1.81 per cent for the accessible area indicates a very poor return in terms of allowable cut on the physical investment represented by the inventory. As previously indicated, the actual return through cutting is a great deal less at 0.6 per cent of the 1959 accessible inventory. At this stage, the allowable cut should not exert any limitation on the use of timber, except for particular species and in specific locations.

The state of the age-class distribution was determined for a few provinces for which adequate information was provided in the inventory reports; Table 3 is a summary of this. It is evident from examination of this table that there is a great preponderance of mature and overmature timber in almost all provinces. Manitoba, with five per cent *mature* area and 95 per cent well distributed in younger age-classes, most closely resembles the ideal conditions; it also has one of the highest allowable cut/inventory ratios.

However, distribution of age classes by area which appears satisfactory on a provincial basis may, in fact, be quite unsatisfactory. For management purposes the forest land must be broken down into individual units or working-plan areas. An ideal distribution of area by age classes for a province is attained only when each of the management units of which it is composed has an ideal distribution. A concentration of any age-class in one region leading eventually to an excess of overmature timber, will seriously impede the realization of the potential of the land.

Certain stands, including those consisting mainly of balsam fir, maple, beech and poplar, and to a lesser extent, white pine, jack pine, lodgepole pine and spruce, may so deteriorate in volume and in quality with overmaturity as to lose all commercial value. Some of these stands will be liquidated eventually by insects (4), disease, or windthrow, but others will occupy their sites indefinitely to the detriment of the development of wood using industries and the utilization of the growth potential of the land. To the extent that these derelict stands occupy space in the areas accessible to present markets they cause an econo-

Table 3. Productive Forest Areas by Age Classes
Accessible Area Only

Province	Young Immature (1-40 yrs.)		Old Immature (41-80 yrs.)		Total Immature (1-80 yrs.)		Mature and Overmature (81-yrs.)		Total	
	7,000 acres	%	7,000 acres	%	7,000 acres	%	7,000 acres	%	7,000 acres	%
Newfoundland (Island)	3,699	45.3	2,243	27.5	5,942	72.8	2,223	27.2	8,165	100
New Brunswick	3,794	27.5	6,532	47.3	10,326	74.8	3,484	25.2	13,810	100
Ontario	9,846	13.1	31,166	41.6	41,012	54.7	33,987	45.3	74,999	100
Manitoba	10,674	50.8	9,193	43.8	19,867	94.7	1,121	5.3	20,988	100
Saskatchewan	4,714	44.5	4,008	37.9	8,722	82.4	1,869	17.6	10,591	100
Alberta	N.A.		N.A.		33,300	90.0	3,700	10.0	37,000	100
*British Columbia — Coast	2,831	21.7	460	3.5	3,291	25.2	9,767	74.8	13,058	100
*British Columbia — Interior	42,586	43.9	11,472	11.8	54,058	55.7	42,939	44.3	96,997	100
Total					176,518	64.0	99,090	36.0	265,608	100

* British Columbia includes both Accessible and Potentially Accessible Forested Area.

mic loss to the land owners. To the extent that they thwart the establishment of industry in areas presently unserviced by a market for raw wood they cause a loss to industry as well as to the land owners. Most of the provincial inventories fail to recognize this situation in the classification of forests. It is therefore not known precisely how important this factor is in constraining the productive capacity of the land. Foresters are fully aware of its existence however, and extensive areas in the eastern and central forests are known to be in this category.

The reclaiming of these lands for commercial production is a problem which will not be easily solved. Markets for the utilization of such overmature material are limited to those in which wood of inferior quality is usable, such as for fuel, charcoal or certain classes of pulp. Since these markets are generally well serviced from the by-products of the harvesting or manufacturing process of the more valuable forest products, it is likely that this decadent timber will remain a useless impediment for a long time to come.

Because the allowable cut is inclined to be influenced by the volume of accumulated growth in mature timber, it may not represent the sustained potential of the land. Also, since in the allowable cut the conditions of management visualized in the cut-over area are rarely defined, it represents a very unstable base for any but short-term plans.

In the interests of long-term planning, an estimate was made of the productive capacity of the land by provinces under specified conditions of management and irrespective of existing accumulations of mature timber. The results of these calculations are shown in Table 4. This productivity, designated here as the *natural productivity,* is based on existing inventory data covering only accessible timberland. It assumes that the land will be well stocked (between 50 and 90 per cent, varying with provinces) when cutting takes place at maturity and that regeneration of species well adapted to the site will follow immediately after cutting or fire. The natural productivity is the annual gross merchantable volume growth per acre which such an ideal forest would produce. It does not provide for any intermediate cutting and some increase in stocking would be possible under close management; the natural productivity would therefore be greatly exceeded through intensive forestry.

Paterson (27) has evolved a strongly correlated index relating potential productivity in the yield of wood per acre to certain climatic factors which he calls the *climate vegetation productivity* (CVP) index. This index varies from about 30,000 to 30 corresponding to annual growth capacities of from 215 to 7 cubic feet per acre per year. A CVP index of 25 corresponds to zero productivity. An appraisal of the potential productivity of Canada based on precipitation, warmth and light indicates an annual yield of 42.6 cubic feet per acre per year on 456 million acres or a total potential of 19,450 million cubic feet per year. This may be compared with the completely independent estimate shown in Table 4 where the natural productivity of the accessible forest land is 11,377 million cubic feet for 457 million acres or 24.9 cubic feet per acre per year.

The strong agreement concerning areas for which the estimates are shown must be considered as largely coincidence. The differences in the estimates of annual productivity per acre may be due in part to the fact that the natural productivity is in terms of gross *merchantable* volume while the potential productivity is presumably gross *total* volume although not defined as such. In addition, the natural productivity estimate assumes no more than good stocking in mature stands at rotation age without intermediate cuttings whereas the potential productivity rating assumes that "..... scientific management is carried on with maximum economic yield as the aim." This implies an approximation of full stocking and, in many areas, intermediate cuttings resulting in considerably higher yields over the rotation.

The allowable cut may exceed the natural productivity where the liquidation of mature timber is contemplated. A reduction of the allowable cut to the level of the natural productivity must be made eventually, unless the intensity of management is such as to improve stocking beyond that used in the calculation of natural productivity or additional volume is recovered in intermediate cuttings. Where no liquidation of mature timber is planned and where the standards of management do not require the establishment of well stocked stands immediately following harvesting, the allowable cut will be less than the natural productivity. Plans for the liquidation of a part of the growing stock may raise the allowable cut to exceed the natural productivity, although the forestry operations to be undertaken on the cutover area may be at a very low level; this will require a drastic reduction of the allowable cut when the mature timber is gone. The allowable cut is therefore not a constant quantity; it fluctuates with the inventory and level of management. The natural productivity is an expression of the basic and continuing ability of the land to produce under a prescribed standard of management.

In Table 5, a comparison is given, by provinces, of the allowable cut for 1956 and the natural productivi-

Table 4. Natural Productivity of the Productive Forest Land Reported in 1959 as being Accessible

	Access.[1] Area '000 acres	Pot.[1] Area Access. '000 acres	Natural Productivity per acre per year			Natural Productivity per year		
			Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total
			(cubic feet)			(millions cu. ft.)		
Newfoundland, Island	7,990	175	17.0[3]	1.0[9]	18.0	136	8	144
Newfoundland, Labrador	9,223	2,125	17.0[a]	1.0[a]	18.0	157	9	166
Prince Edward Island	348	—	13.0[b]	7.4[b]	20.4	4	3	7
Nova Scotia	9,668	—	13.0[b]	7.4[b]	20.4	126	72	198
New Brunswick	15,237	—	13.0[4]	7.4[4]	20.4	198	113	311
Atlantic group	42,466	2,300	14.6	4.8	19.4	621	205	826
Quebec	85,862	55,112	22.6[c]	5.6[c]	28.2	1,940	481	2,421
Ontario	83,605	22,468	14.2[5]	14.0[5]	28.2	1,187	1,170	2,357
Central group	169,467	77,580	18.5	9.7	28.2	3,127	1,651	4,778
Manitoba	23,837	13,710	9.5[6]	1.9[6]	11.4	226	45	271
Saskatchewan	16,322	9,923	7.0[7]	12.0[7]	19.0	114	196	310
Alberta	71,442	2,438	19.4[8]	24.2[8]	43.6	1,385	1,730	3,115
Yukon Territory	9,088	17,856	5.9[9]	1.1[9]	7.0	53	10	63
Northwest Territories	7,488	14,016	8.6[9]	4.4[9]	13.0	64	33	97
Prairies and North group	128,177	57,943	14.4	15.7	30.1	1,842	2,014	3,856
British Columbia, coast	10,292[2]	2,765[2]	35.3[2]	0.8[9]	36.1	461	10	471
British Columbia, interior	87,215[2]	9,782[2]	13.1[2]	0.7[9]	13.8	1,373	73	1,446
British Columbia (total)	97,507	12,547	15.5	0.7	16.2	1,834	83	1,917
Canada (grand total)	437,617	150,370	16.2	9.0	25.2	7,424	3,953	11,377

Notes: (a) Labrador assumed equal to Newfoundland Island.

(b) Assumed equal to New Brunswick.

(c) Total assumed equal to Ontario; distributed between softwood and hardwood on the basis of present inventory volumes of these two groups.

Sources: 1. Canadian Forestry Statistics, 1959.

2. Continuous Forest Inventory of British Columbia, 1957 — *Natural Productivity per year* has been adjusted to areas shown accessible in 1959 (B.C. Accessible Area 117,440,000 acres (8)).

3. Newfoundland: Royal Commission on Forestry, 1955.

4. New Brunswick Forest Inventory: a summary report, 1958.

5. Ontario: Forest Resources Inventory, 1953—1958.

6. Manitoba: Forest Resources Inventory, 1956.

7. Saskatchewan's Forest Inventory, 1947 to 1956.

8. Alberta: a summary of the forest resources and their potential development, 1956.

9. The Outlook for the Canadian Forest Industries. (Natural productivity assumed equal to the allowable cut).

ty for the area then classified as accessible. It is significant that, despite the preponderance of mature and overmature timber available in most provinces, the allowable cut is less than 75 per cent of the natural productivity. It is evident that most provinces are making no allowance in their allowable cut calculations for the possible liquidation of the excessive inventory of old timber. It is also clear that a very low level of management is expected on the lands to be cut over in the future, because basic management

Table 5. Allowable Cut and Natural Productivity Based on the Area Reported in 1956 as being Accessible

Area	Access. Area (millions acres)	Natural Productivity per acre (Table 4)			Total Natural Productivity			Allowable Cut 1956 (Table 1)			Allowable Cut as a Proportion of Natural Productivity		
		Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total
		(Cubic feet)			(millions cu. ft.)			(millions cu. ft.)					
Newfoundland	8.1	17.0	1.0	18.0	138	8	146	123	8	131	0.89	1.0	0.90
Prince Edward Island	0.3	13.0	7.4	20.4	4	2	6	8	3	11	2.00	1.50	1.83
Nova Scotia	10.0	13.0	7.4	20.4	130	74	204	136	34	170	1.05	0.46	0.83
New Brunswick	14.5	13.0	7.4	20.4	189	107	296	300	150	450	1.59	1.40	1.52
Atlantic group	32.9	14.0	5.8	19.8	461	191	652	567	195	762	1.23	1.02	1.17
Quebec	90.4	22.6	5.6	28.2	2,043	506	2,549	995	332	1,327	0.49	0.66	0.52
Ontario	82.6	14.2	14.0	28.2	1,173	1,156	2,329	783	671	1,454	0.67	0.58	0.62
Central group	173.0	18.6	9.6	28.2	3,216	1,662	4,878	1,778	1,003	2,781	0.55	0.60	0.57
Manitoba	20.6	9.5	1.9	11.4	196	39	235	100	73	173	0.51	1.87	0.74
Saskatchewan	16.5	7.0	12.0	19.0	116	198	314	134	169	303	1.15	0.85	0.96
Alberta	37.5	19.4	24.2	43.6	727	908	1,635	450	411	861	0.62	0.45	0.53
Yukon Territory	9.1	5.9	1.1	7.0	50	11	61	50	11	61	1.00	1.00	1.00
Northwest Territories	7.5	8.6	4.4	13.0	63	32	95	63	32	95	1.00	1.00	1.00
Prairies and North group	91.2	12.6	13.0	25.6	1,152	1,188	2,340	797	696	1,493	0.69	0.59	0.64
British Columbia, coast	10.6	35.3	0.8	36.1	374	9	383	641	9	650	1.71	1.00	1.70
British Columbia, interior	44.6	13.1	0.7	13.8	584	32	616	706	32	738	1.21	1.00	1.20
British Columbia, (total)	55.2	17.4	0.7	18.1	958	41	999	1,347	41	1,388	1.41	1.00	1.39
Canada (grand total)	352.3	16.4	8.8	25.2	5,787	3,082	8,869	4,489	1,935	6,424	0.78	0.63	0.72

involving only the regeneration of the land and cutting at maturity would indicate a ratio of unity.

Most allowable cut calculations recognize variations in stand density or delays in the regeneration of successive crops. Therefore, it must be assumed that the estimates of allowable cuts in most provinces anticipate relatively poor stocking of species adapted to the site or delayed regeneration. This cautious approach is one which can readily be supported by observations in many of the productive forest areas of Canada. The failure of certain species to regenerate under certain conditions is well known (5, 11, 16, 30). Areas which do not regenerate well to desirable species are frequently occupied by off-site species or herbaceous growth which may delay desirable regeneration for many years. In part it is this delay or the fear of a low density of regeneration that prompts the assignment of an allowable cut far lower than the capacity of the land.

In Table 1, an attempt was made to adjust the 1956 allowable cut to compensate for the increased volume shown by the 1959 inventory summary. This adjustment, while quite reasonable from a theoretical point of view, would exceed the allowable cut determined by the more conservative methods employed by most provinces. In spite of this, however, it may be noted in Table 6 that the softwood allowable cut on accessible productive land amounting to 7,082 million cu-

Table 6. Allowable Cut and Natural Productivity for the Productive Forest Land (Accessible Area as Reported in 1959)

Area	Total Natural Productivity (Table 4) (millions cu. ft.)			Allowable Cut (Table 1) (million cu. ft.)			Allowable Cut as a Proportion of Natural Productivity		
	Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total
Accessible Area									
Newfoundland Island	136	8[a]	144	249	18	267	0.85	1.06	0.86
Newfoundland Labrador	157	9	166						
Prince Edward Island	4	3	7	5	2	7	1.25	0.67	1.00
Nova Scotia	126	72	198	162	83	245	1.28	1.05	1.24
New Brunswick	198	113	311	419	187	606	2.11	1.65	1.95
Atlantic Group	621	205	826	835	290	1,125	1.34	1.41	1.36
Quebec	1,940	481	2,421	870	345	1,215	0.45	0.72	0.50
Ontario	1,187	1,170	2,357	736	740	1,476	0.62	0.63	0.63
Central Group	3,127	1,651	4,778	1,606	1,085	2,691	0.51	0.66	0.56
Manitoba	226	45	271	114	75	189	0.50	1.67	0.70
Saskatchewan	114	196	310	152	194	346	1.33	0.99	1.11
Alberta	1,385	1,730	3,115	574	575	1,149	0.41	0.33	0.37
Yukon Territory	52[1]	12[1]	64	52	12	64	1.00	1.00	1.00
Northwest Territories	69[1]	39[1]	108	69	39	108	1.00	1.00	1.00
Prairies and North Group	1,846	2,022	3,868	960	893	1,855	0.52	0.44	0.48
British Columbia, coast	461	15[1]	476	1,211	15	1,226	2.63	1.00	2.57
British Columbia, interior	1,373	31[1]	1,404	2,469	31	2,500	1.80	1.00	1.78
British Columbia (total)	1,834	46	1,880	3,680	46	3,726	2.00	1.00	1.98
Canada (grand total)	7,428	3,924	11,352	7,082	2,316	9,398	0.95	0.59	0.83
Potentially Accessible Area	1,245	282	1,527	1,245	282	1,527	1.00	1.00	1.00
All Productive Forest	8,673	4,206	12,879	8,327	2,598	10,925	0.96	0.61	0.85

[a] Natural productivity assumed equal to allowable cut.

bic feet is appreciably less than the natural productivity of the land, while the hardwood allowable cut is only slightly more than one-half of the productive capacity of the land. In the 1959 estimate of the allowable cut, recognition is given to the desirability of liquidating some of the existing backlog of mature volume; it does not assume any better post-harvest forestry methods than were implicit in the 1956 estimate.

It is a matter of some coincidence that the allowable cut for conifers determined for 1959 as shown in Table 1 is so close to the calculated natural productivity for this species group. The allowance for the liquidation of mature timber made in the allowable cut offsets the loss due to the low level of management which the calculations anticipate. As far as conifers are concerned, therefore, the 1959 allowable cut approximates the long-term productivity under extensive management, i.e. the yield under well stocked stands cut once at maturity. The hardwood natural productivity which is constantly increasing (11, 16) is now almost twice the calculated 1959 allowable cut of this species group.

Losses Due to Insects, Disease and Fires

The natural productivity of the land and the allowable cut determinations, described in the previous section, are based principally on inventory volumes observed on the ground at maturity. Thus allowance has already been made for the losses due to insects and diseases the stands sustained while coming to maturity. As far as these losses are concerned, therefore, the primary consideration is the reduction in merchantable volume which might occur in mature stands ready to harvest and which could not be salvaged. The loss in trees above the sapling stage has been estimated by the Forest Entomology and Pathology Branch of the Department of Forestry (formerly of the Canadian Department of Agriculture[e]) as 700 million cubic feet per annum without any allowance for salvage. Since this estimate includes both semi-mature and the ma-

ture and overmature timber, it is somewhat high as a measure of the loss of mature timber. However, most of the losses due to these agencies will be in the older timber so the estimate of 700 million will be adjusted for possible salvage only.

It is estimated (20) that all the land in small holdings (23 million acres) and 52 per cent of the forest land occupied by industry (158 million acres) is accessible; this represents 105 million acres, or 17 per cent of the total productive forest land of the nation. Assuming that all diseased and insect-killed wood within this area can be salvaged, the net national loss would be 580 million cubic feet. (It is recognized that some loss will occur within the accessible area, but to offset this some damaged timber outside the accessible area will be salvaged, also most of the loss in semi-mature timber included in the 700 million estimated gross loss has already been allowed for in the natural productivity and allowable cut calculations.)

The average area burned annually by forest fires 1948 – 1957, was 1,016 thousand acres of productive forest land (9). The merchantable timber included in this area amounted to 409 million board feet (76 million cubic feet) in sawtimber and 2,070,000 cords of small material (176 million cubic feet). The total merchantable volume within the burned area, therefore, averaged 252 million cubic feet per year. Since 75 to 80 per cent of all fires are caused by man, it may be assumed, for want of a better basis of distribution, that 75 to 80 per cent of the burned area is in the occupied (and therefore most accessible) timberlands. Thus 195 million cubic feet of fire-killed timber occurs within this occupied area of which it is estimated (20) that 75 to 80 per cent can be economically salvaged. The net loss using the 75 per cent salvage figure amounts to 49 million cubic feet in the occupied forest land and 57 million cubic feet in the unoccupied forest land, a total net loss of 106 million cubic feet per year. While such is clearly not the case, it will be assumed, for the sake of conservatism, that this loss all occurs within the area classed as *accessible*.

A summary of the gross allowable cut, the estimated depletion due to insects, disease and fire and the net available for commercial utilization is shown in Table 7 for 1956 and 1959; the natural productivity with similar allowances is also included.

Future Utilization of the Natural Productivity

As indicated in previous sections, the primary limitations to the present utilization of the productivity of the soil are lack of markets for mature timber and the occupancy of accessible productive land by non-commercial overmature stands.

For many years to come, the extent to which the productivity of the land will be used will depend on these same factors and, in addition, will be greatly influenced by current forestry operations undertaken to provide for low-cost high-quality wood on lands now being cut over.

In spite of the large unused allowable cut available in Canada, growth of our forest industries has been much slower in recent years than world averages (13). From 1948 to 1956 the world production of sawn wood increased at the compound rate of 3.8 per cent a year and that for wood pulp production 5.5 per cent. In the same period, the increase in Canadian lumber production was at the rate of 2.5 per cent and that of wood pulp 3.2 per cent (7). While projections of world production of all forest products are not available, the current and anticipated increase in the rate of production of newsprint is highly significant. The 1960 issue of *News print Data* (25) reports as follows: "... (the charts)....emphasize the much faster rates of capacity growth of newsprint mills in the U.S.A., Scandinavia and All Others than in Canada and Other Europe."

The lack of development of Canadian timber resources is not due to any scarcity of raw material and, since there is no evidence to suggest that political interference has discouraged investment, the limiting factor must be of an economic nature.

The accessible areas from which relatively cheap wood can be procured have been placed at the disposal of industry. From these areas, which now account for 26 per cent of the productive forest land of Canada, the cheapest wood was procured at a time when little was done to ensure well stocked stands of valuable species following cutting. As a result, many areas cut over 50 to 75 years ago, which should now be producing the cheapest yet most valuable commercial wood, are producing timber of species (5, 11, 16) and quality which must compete with an almost unlimited supply of similar but cheaper wood closer to markets (19). The trend towards pulping more of this low-grade timber, which is largely hardwoods, is evident here (20, 28) and elsewhere throughout the world. Canada, as an exporter of forest products, is limited in the development of industry based on such material because it is readily available just where our comparable product might otherwise be shipped.

Because of the higher demands on the forest resource imposed by labor, government and management in

Table 7. Gross and Net Allowable Cut and Natural Productivity

Region	Gross			Losses			Net		
	Allowable Cut (Table 1)		Natural Productivity (Table 4)	Insect and Disease	Fire	Total	Allowable Cut		Natural Productivity (based on 1959 Accessible Area)
	1956	1959					1956	1959	
	(millions of cu. ft.)								
	Accessible Forest Area								
Atlantic									
Softwood	567	835	621	45	1	46	521	789	575
Hardwood	195	290	205	9	—	9	186	281	196
Total	762	1,125	826	54	1	55	707	1,070	772
Central									
Softwood	1,778	1,606	3,127	230	28	258	1,517	1,348	2,869
Hardwood	1,003	1,085	1,651	83	—	83	920	1,002	1,568
Total	2,781	2,691	4,778	313	28	341	2,440	2,350	4,437
Prairies and North									
Softwood	797	961	1,842	28	31	59	738	902	1,783
Hardwood	696	895	2,014	70	31	101	595	794	1,913
Total	1,493	1,856	3,856	98	62	160	1,333	1,696	3,696
British Columbia									
Softwood	1,347	3,680	1,834	111	5	116	1,231	3,564	1,718
Hardwood	41	46	46	4	—	4	37	42	42
Total	1,388	3,726	1,880	115	5	120	1,268	3,606	1,760
All Groups									
Softwood	4,489	7,082	7,424	414	65	479	4,010	6,603	6,945
Hardwood	1,935	2,316	3,916	166	31	197	1,738	2,119	3,719
Total	6,424	9,398	11,340	580	96	676	5,748	8,722	10,664
	Potentially Accessible Area								
All Groups									
Softwood	1,758	1,245	1,245[a]	(All losses assumed			1,758	1,245	1,245
Hardwood	439	282	282[a]	to have occurred in			439	282	282
Total	2,197	1,527	1,527[a]	Accessible Area)			2,197	1,527	1,527
	Total Productive Area								
All Groups									
Softwood	6,247	8,327	8,669	414	65	479	5,768	7,848	8,190
Hardwood	2,374	2,598	4,198	166	31	197	2,177	2,401	4,001
Total	8,621	10,925	12,867	580	96	676	7,945	10,249	12,191

[a] Assumed equal to Allowable Cut 1959 — no information available for separate calculation of natural productivity.

Canada than in competing nations, the expansion of industry here can proceed only as wood of superior quality is available at a low cost. Failure to invest years ago in order to produce this superior wood on the most accessible areas forces us to go further afield for it. This operation, which involves capital expenditures of from $5,000 to $15,000 and annual maintenance costs of over $150 for each mile of road built (20), results in additional production costs of as much as $1.00 per cord, or between $10 and $15 an acre. This tends to discourage expansion in Canada when more favorable conditions exist elsewhere.

The relatively high costs of transportation for the bulk of Canadian raw wood products not only discourages expansion but also reduces the wood grower's net return to such a low level that there is little incentive for him to invest in the production of the raw material. Unfortunately, this situation will get pro-

gressively worse. As expenditures for developing Canada's wood resources rise, thereby leaving less for the growing of cheap accessible wood, other countries with less land area are learning how to grow wood at competitive prices. The latter technique leads to ever-lower wood costs while the Canadian practice must result in ever-increasing ones.

Timber prices in North America have, on a constant currency basis, moved fairly steadily upwards for nearly a century at a rate of almost two per cent annually; prices for lumber in Sweden have increased annually at an average rate of 0.8 per cent (12). Increased expenditure in caring for accessible forest (as in Scandinavia) or in the establishment of plantations (as in New Zealand and Southern United States) is now being undertaken. The evidence suggests that these measures are producing timber at a cost which renders much of Canada's vast store of God-given timber submarginal in world trade. In this connection it is interesting to learn from *Newsprint Data 1960* (25) that the areas where major expansion of the newsprint industry has occurred or is contemplated are those where rapid forest growth has been amply demonstrated, such as the southern U.S.A. (18), Japan and Britain, or where a continuing program of investment in the maintenance of the forest resource dates back one rotation or more as in Scandinavia (2, 3).

Improvements in technology, both in the wood pulp field and in the use of natural wood, have radically reduced the premium which once was ascribed to Canadian spruce, pine and Douglas fir. These species are now preferred only if they compete in price with a wide range of alternative species and products. In Canada, low-cost wood of these species for the expansion of industry is a thing of the past and can become available again only through the intensive management of the most accessible and most productive lands. Canadian timber is rapidly approaching the point in time when it will be used in increasing amounts only if it can be grown on accessible areas at a cost which is less than the cost of tapping the presently inaccessible areas.

The full use of the natural productivity of all of the Canadian forest lands is most unlikely in the foreseeable future; long before this happens, the highly productive accessible land should be yielding, through intensive forestry measures, at least twice its natural productivity.

Without knowing precisely what the future returns might be from high-quality wood, provided through intensive forestry measures begun immediately, it is impossible to forecast what interest present investment might yield. Many prominent foresters are convinced that guaranteed earnings are not a prerequisite for investment in forestry. The following quotation defines the Swedish policy of promoting a highly successful forestry program (3).

> "According to the intructions for the Royal Forest Service, issued by the Swedish Government on March 1, 1935, 'the general policy.... is that forestry shall be practised on the basis of sustained yield, with, if possible, regular fellings, and that production, in terms of money, shall be high.'[1] It means that the management goal in the forest enterprise is to obtain, on the sustained yield basis, the highest possible operating profit in monetary terms (according to the principle of "forest rent", in which the term "cost" includes only the running business expenses, and excludes the item of return on the money capital being used for the investments) and not the highest possible profitability of the forest capital (according to the principle of "soil rent", in which the computation of costs is accomplished on the basis of compound interest)."

[1]The Swedish Forest Service, Stockholm. 1956. p. 10.

Relatively little is known in Canada about the cost of intensive forestry, the resulting changes in growth which such operations are likely to produce, or the markets which the cultivated material may satisfy. It seems evident, therefore, that a policy of management based on the principle of *forest rent* as defined above is better suited to Canadian conditions than one which presupposes well defined procedures and accurate estimates of future returns.

Data gleaned from the annual reports of the provincial forestry departments and additional information provided by the forest industries (20) indicate an annual direct expenditure for forestry operations (including protection, roads, planting, and management) of roughly $50 million per year. (An accurate estimate is impossible because of a lack of breakdown of expenditures, by both governments and industry, into detailed categories.) Of this $50 million, it is estimated that the provinces provide $27 million and industry $23 million. Prorated over our annual cut of 2.9 billion cubic feet of industrial wood, this amounts to 1.7 cents per cubic foot. The proportion of the total volume of production which is recovered from the 26 per cent of productive forest land occupied by industry cannot be accurately determined. It is probable that small land holdings, which represent about 12.5 per cent of the total occupied forest land, provide at least 25 per cent of the total annual harvest of wood (22). On this basis, the cost of forestry operations on lands occupied by industry wou-

ld be at the rate of about 2.1 cents per cubic foot of wood harvested. The primary items of cost are protection (40 per cent), and roads (23 per cent), amounting to 1.3 cents per cubic foot. The remaining 0.8 cents per cubic foot is spent in management work such as cruising, management-plan preparation and silviculture, the latter at the present time amounting to a very small proportion of the total.

The average direct cost of forestry operation in Canada of 2.1 cents per cubic foot might reasonably be compared with the average (1936-1954) expenditure of 5.5 cents per cubic foot (expressed in 1954 dollar values) by the Swedish Forest Service on forestry operations. Partly as a result of continuous attention to forest production for more than one rotation, the timber now being sold in Sweden is of high value; current expenditures of 10.0 cents per cubic foot for forestry operations represent only 67 per cent of current revenue from the sale of timber which is about 15 cents per cubic foot.

Canadian expenditures on the maintenance of the resource are preponderantly for protection, road construction, road maintenance, inventory, and planning. These things, though desirable and often essential in sustaining revenue from the forest, do not contribute directly to a better recovery of the productive capacity of those accessible fruitful lands which should provide raw material for expansion of industry. The policy of industry and provincial governments of applying a thin veneer of forest management in the form of protection and low-intensity silviculture over an extended area cannot provide, at competitive prices, the quality of wood needed to encourage the growth of the wood-using industries,

Our tremendous unused allowable cut has apparently created the impression amongst forest administrators in both government and industry (20) that expenditures for intensive forest management are rarely justified until all of the potential allowable cut within reach of *extensive* forestry methods is accounted for. This approach presupposes that (a) roads can be extended indefinitely to presently inaccessible cutting areas, and that timber can be recovered from these areas out of low-density stands from trees of poor quality at a total cost which will be less than that for timber systematically grown on the accessible productive land, and (b) no land within the accessible area can compete on the basis of cost of growing wood with areas presently under intensive management in other parts of the world.

With respect to the first point above, the record of the white pine lumber industry in eastern United States and Canada demonstrates the folly of assuming that cutover unmanaged areas will produce a raw material capable of maintaining the competitive position of the industry. Possibly a direct parallel cannot be drawn between the white pine industry of the nineteenth century and those flourishing today, but, worldwide trends in the expansion of industry invite this comparison.

Little is known about the productive capacity of Canadian forest land under intensive management. The yields of which the land is capable, as indicated in Table 4 and verified by research and demonstrations suggest that much Canadian forest land could easily compete with countries practicing intensive forestry. The yield in Sweden resulting from an investment of $1.34 (2) per acre per year is 24.3 cubic feet (31). The average natural productivity (requiring only good stocking and a market at maturity) of the accessible area of Canada exceeds this figure, indicating that extensive areas have much higher potentials.

According to Paterson (27), intensive forestry, which does not alter the natural assets created by the climate, will find its maximum productivity in climatic regions with CVP Index values between 100 and 500 corresponding to annual yields of between 44 and 96 cubic feet per acre per year respectively On the basis of estimates provided in Paterson's study, Canada, with 142 million acres, possesses 13.4 per cent of the total world forest area within this category. By way of comparison, the United States has 203 million acres and Sweden 34.6 million. Based on the forest area on which intensive forestry can presumably find a reasonable return, Canada ranks third after the United States and the Soviet Union.

At Sweden's level of 24.3 cubic feet per acre per year, the area in Canada needed to produce the present requirements of industrial wood from land occupied by industry (2.2 billion cubic feet) would be 90 million acres, or only about 57 per cent of the 158 million acres presently occupied by industry; this is a mere 15 per cent of our productive forest land. Failure of land administrators to use the potential of alienated lands has resulted in the withdrawal from use not only of much accessible productive capacity but also much mature and semi-mature timber which has already been, or will eventually be, lost through decadence.

It is very probable that an average recovery of 24.3 cubic feet per acre per year for all of the productive forest lands is possible in Canada through intensive management. It would not be realistic to suppose, however, that Canada's recoverable potential in the foreseeable future is ($\frac{24}{15}$ =) 14.7 billion cubic feet per

year. Long before the physical limitation would be effective, the costs of growing wood would prevent expansion. The economic limitations of Canadian wood production are inextricably involved with the ability of Canadian land to compete on a *cost of growing wood* basis with other nations. Many factors besides the natural productivity of the land will be pertinent to this. Not the least of these will be the attitude here of industry and government toward investment in forestry and the extent to which foreign countries compete by taking advantage of their own land potential.

It has been proven in many regions that a complete program of management on a limited area is more effective in producing high-value wood at a low cost than an equal expenditure on a partial program over a wider area (17, 32). This applies to the production of all species and all products, but is particularly applicable to the growing of sawlogs and veneer quality wood. It is in the production of quality products that expenditures for management will yield the greatest returns (17, 32). The trends in the production of wood pulp (14, 15, 20, 28) suggest that the time is near when most of the raw material for the pulp industry will be by-products from the growing or manufacture of more valuable wood products. It would seem advisable therefore, to plan for the multiple use of the material produced when instituting management designed to raise land productivity. Full advantage should be taken of the opportunities provided by the pulpwood market to produce, at a minimum total cost, both the bulk volume required for wood pulp and the quality volume needed for sawlogs and veneer. Areas on which growth conditions are well suited to the production of quality products should have top priority for intensive management.

Eastern white pine is one of the few, if not the only, species in which the cut for extensive areas appears to be restricted by the availability of physical resources. In Ontario, for instance, the actual annual cut of 130 million board feet approximates the calculated allowable cut. For this species the opportunity for investment in protection against fire and blister rust and in a comprehensive program of weevil spraying, pruning and release from competition would appear to be an eminently wise move to provide for the future requirements of the white pine lumber industry.

Similar steps aimed at providing certain species and quality classes of raw material in specific areas must be constantly under review. The object may be to forestall a local shortage or to provide better raw material at low prices to encourage the expansion of industry. Local conditions will determine the nature of the program and the intensity of forestry operations required. A complete and well balanced plan providing for all of the factors influencing eventual yield in terms of volume and quality should be a requirement. A high physical potential of the land unquestionably exists; the extent to which this potential will be realized will depend in large measure on the net revenue available to the timber grower from timber sales and the extent to which such available revenue is dedicated to forestry use.

Notes

[a] The *natural productivity* is the annual yield of volume which could be expected from well stocked stands harvested at maturity with no intermediate cuttings.

[b] A questionnaire submitted to a cross section of Canadian forest industries (Appendix I) indicates that as the term accessible is used by the industries it refers to land that, on the average, is within three miles of a main road. Most of the area above referred to as accessible would be far more than three miles from the nearest road.

[c] The data for 1959, including that for Quebec and Newfoundland, were taken from Canadian Forestry Statistics, 1959 (8).

[d] Von Mantel's and Hundeshagen's formulae are based essentially on the use of this technique.

[e] Private correspondence with Dr. B. M. McGugan, Associate Director.

References

[1] Alberta. Department of Lands and Forests, Forest Service. *Alberta, Canada: a summary of the forest resources and their potential development.* Edmonton. 1956. p. 7.

[2] Algvere, K.V. "Research in Economics of Forest Management," *Svenska Skogsvardsföreningens Tidskrift*, Vol. 50, No. 4. 1952. pp. 373-379.

[3] Algvere, K.V. "Historical Costs of Timber Growing Operations in a Permanently Established Forest Enterprise," *Svenska Skogsvardsföreningens Tidskrift*, Vol. 56, No. 1. 1958. pp. 69-92.

[4] Blais, J.R. "The Recurrence of Spruce Budworm Infestations in the past Century in the Lac Seul Area of Northwestern Ontario," *Ecology*, Vol. 35, No. 1. 1954. pp. 62-71.

[5] Bonner, E. "Reforestation Problems in Eastern Spruce Forests," *Forestry Chronicle*, Vol. 36, No. 2. 1960. pp. 153-155.

[6] British Columbia. Department of Lands and Forests, Forest Surveys and Inventory Division. *Continuous Forest Inventory of British Columbia; Initial Phase* 1957. Victoria, 1958. pp. 148+(44).

[7] Buckingham, F. *Ontario Timber: Trends and Prospects.* Ontario Department of Lands and Forests, Unpublished report. 1960.

[8] Canada. Dominion Bureau of Statistics. *Canadian Forestry Statistics. 1959.* Ottawa. 1960. p. 24.

[9] Canada. Department of Northern Affairs and National Resources, Forestry Branch. *Forest Fire Losses in Canada, 1958 and 1959.* Ottawa. 1960. (Mimeographed).

[10] Canada. Royal Commission on Canada's Economic Prospects. *The Outlook for the Canadian Forest Industries*, by the Forestry Study Group. Queen's Printer. Ottawa. March 1957. p. 261.

[11] Candy, R.H. *Reproduction on Cut-over and Burned-over Land in Canada.* Canada Department of Resources and Development, Forestry Branch. Silvicultural Research Note No. 92. Ottawa, 1951. p. 224.

[12] Entrican, Alex. R. *The Influence of Delivered Prices of Forest Produce on Silvicultural Practice in a Developing Forest Economy.* Fifth World Forestry Congress, Seattle, Washington. 1960. p. 16.

[13] Food and Agriculture Organization of the United Nations. "The Growth of Forest Industries and Their impack of the World's Forests," *The State of Food and Agriculture, 1958*, Chapter IV Rome. 1958. pp. 163-197.

[14] Fedkiw, John, Neil J. Stout, and Frederick S. Hopkins. "The Role of Quality in the Eastern White Pine Industry," *The Northeastern Logger*, Vol. 8, No. 4: pp. 12-13, 36-40. 1959; Vol. 8, No. 9: pp. 14-15, 18-19. 1960; Vol. 8, No. 10; pp. 16-19, 22-23, 39. 1960. Reprinted by State University, College of Forestry at Syracuse University. Syracuse, N.Y. 1960.

[15] Fedkiw, John, et al. "Economic Aspects of Growing High Quality Pine Through Pruning," *The Northeastern Logger*, Vol. 8, No. 10. 1960. pp. 16-19, 22-23, 39.

[16] Hosie, R.C. *Forest Regeneration in Ontario.* University of Toronto Forestry Bulletin No. 2. University of Toronto Press. Toronto. 1953. pp. XIV + 134.

[17] King, D.B., C.H. Stoltenburg, and R.S. Marty. *The economics of White Pine Blister Rust Control in the Lake States.* Forest Service, U.S. Department of Agriculture. 1960. pp. 38 + 45.

[18] Knight, Vernon J. *The South's Pine Lands, a Study in Forestry.* Paper presented to the Royal Canadian Institute, Toronto, Ontario. January 17, 1959. (unpublished).

[19] Love, D.V. "The Distribution and Availability of Hardwoods in North America," *Pulp and Paper Magazine of Canada*. Vol. 59, No. 10. 1958. pp. 188-192, 222.

[20] Love, D.V. Questionnaire of the Forest Industries of Canada, sent out in 1960 in conjunction with author's paper for *Resources for Tomorrow* Conference (Appendix I of paper).

[21] Manitoba. Department of Mines and Natural Resources, Forest Service. *Forest Resources Inventory, 1956*. Reports Nos. 1-9: Ca. 32 pp. each. Winnipeg. 1956-1960.

[22] New Brunswick. Forest Development Commission. *Report of the New Brunswick Forest Development Commission*. Fredericton, June 1957. pp. xii + 154.

[23] New Brunswick. Department of Lands and Mines, Photogrammetry Branch. *New Brunswick Forest Inventory: a summary report, 1958*. Fredericton. 1958. (A compilation and appraisal based on work conducted from 1951 to 1958). 64 + 12, + 12, + 12, + 10, + 12 + 14 (Approx).

[24] Newfoundland. Royal Commission on Forestry. *Report of the Royal Commission on Forestry, 1955*. St. John's. 1955. pp. 240. 25. Newsprint Association of Canada. *Newsprint Data 1960*. Newsprint Association of Canada. Montreal. 1960.

[26] Ontario. Department of Lands and Forests, Division of Timber Management. *Forest Resources Inventory*. Reports Nos. 1-22: Ca. 30 pp. each (Nos. 1-16); Ca. 40 pp. each (Nos. 17-22). Toronto. 1953-1958.

[27] Paterson, Sten Sture. *The Forest Area of the World and its Potential Productivity*. The Royal University of Göteborg, Department of Geography Bulletin No. 51. Sweden. 1956. p. 216.

[28] Pesez, G.A. The Growing Importance of Hardwoods to the Paper Industry in the Northeast. *Proceedings, Society of American Foresters*. Washington. 1958. pp. 179-181.

[29] Saskatchewan. Department of Natural Resources, Forestry Branch. *Saskatchewan's Forest Inventory 1947 to 1956*. Regina. 1959. pp. 127 + maps.

[30] Silburn, George. "Reforestation Problems in Western Spruce Forests," in *Forestry Chronicle*, Vol. 36, No. 2. 1960. pp. 150-152.

[31] Streyffert, Thorster. *World Timber Trends and Prospects*. Stockholm, Almgivst and Wiksell. 1958. p. 246.

[32] Vaux, Henry. *The Economics of the Young Growth Sugar Pine Resource*. California Agricultural Experiment Station Bulletin No. 738. January 1954. p. 56.

APPENDIX I

Analysis of Replies Received

It is believed that the 26 per cent of productive forest land in Canada occupied at present by the forest industries will be the most important source of Canadian wood in the future.

To learn what is happening on these lands and how the timber cut is being utilized, a questionnaire was sent to 32 pulp and paper companies and 28 lumber companies with operations in Canada. In both cases the questionnaires were sent to selected companies covering a range of geographical and market conditions. The lumber companies selected were generally those with one or more large permanent mills. A useful answer to the questionnaire was received from 23 of the pulp and paper companies and seven of the lumber companies.

The following summary indicates the questions asked and gives an appraisal of the answers received. *Forestry Aspects* (answered by both pulp and paper and lumber companies).

1. Salvage of burned timber.

(a) When land supporting merchantable timber, owned or leased by your company, is burned over, to what extent is the timber salvaged?

Many firms reported that fires had not been serious in their licenses within the last 20 years and almost all indicated that, where large fires had occurred, a large percentage of the burned timber was salvaged. It is estimated from the replies that 75 to 80 per cent of burned timber in the occupied forest land is salvaged.

In at least one case the proportion of burned timber being salvaged in recent years was less than formerly due to increasing cost which precludes the possibility of utilizing wood which may cost more to harvest than the regular unburned timber.

1. (b) Do you expect that accessibility of your lands will improve in the future to permit more complete salvage of burned timber?

The accessibility of company licenses is improving rapidly. It is estimated that within a very few years there will be no serious loss of burned timber due to failure on the part of companies to undertake salvage operations. In pulp and paper production heavily charred wood cannot be utilized and will always be wasted unless suitable for lumber or some product other than standard pulp grades.

2. Intensive forest management for the recovery of a greater part of the growth capacity of the land.

(a) Does your company undertake a forest management program for the recovery of a greater portion of the growth potential of the land held than that which would result from a *clearcut and leave* policy?

Of the 30 questionnaires answered 20 replied positively that a management programme was in effect. Clearcutting was believed by many to be the wisest silvicultural system for their area and objected to the inference that *Clearcut and leave* is the lowest level of management.

Author's note: In managing forest land for forest production one can scarcely do less than clearcut and leave. This does not in any way suggest that clearcutting is not a sound silvicultural method.

2. (b) If so, what types of management operations are undertaken, what acreages are treated and what costs incurred?

(i) Forest fire protection in addition to that supplied by provincial authority or by protective associations. Area to which such protection applied and added annual cost per acre for such protection.

Based on the analysis of returns of companies with a total area of license of 68.9 million acres the average cost per acre of license area is 1.9 cents. Money spent directly for protection is largely concentrated on the areas on which operations are being conducted and on this basis it amounts to a great deal more per acre. The highest reported was $2.50 per acre and the lowest four cents per acre. Higher rates for fire protection generally prevail in the West.

2. (b) (ii) Cutting restricted to mature timber, i.e. immature timber reserved from cutting even though accessible.

With one exception, all of those licensees replying to the questionnaire restrict cutting to mature timber. Immature timber is bypassed even though accessible.

2. (b) (iii) Planting undertaken. Numbers of trees planted, area treated and costs incurred.

Of the 30 companies that replied to the questionnaire about one-third indicated that natural regeneration was adequate and no operations to provide natural or artificial regeneration were required. Thirteen of the pulp and paper companies are now undertaking tree planting operations and have planted 31 million trees since 1930, with most of this work having been done since 1945. The total cost of planting was $1,180,000 and took place on 95,340 acres. The

planting rate therefore is 325 trees per acre costing $12.40. It is important to note that of this amount three companies account for almost 30 million trees, $1,153,000 expenditure and 94,000 acres planted. Companies replying to this question are holders of almost 85 million acres of productive Crown land. Because all companies known to be involved in planting operations were included in the survey it is believed that the totals given here account for virtually all planting on Crown land undertaken in Canada by the forest industries.

2. (b) (iv) Partial cutting of timber stands to recover some of the losses due to decadence. Areas so treated and estimated additional cost per cord of such cutting compared to clear cutting.

With very few exceptions there is no partial cutting of the forest stands by pulp and paper companies. Because of the nature of the product and the quality of the overmature forests cut by some of the lumber companies partial cutting is practiced.

As younger timber is harvested partial cutting will be more advantageous especially where a market for both pulpwood and sawlogs exists.

2. (b) (v) Internal permanent roads maintained for management purposes (fire protection, salvage, partial cutting, forest tending operations, etc.) and not required exclusively for logging purposes. Length of road so maintained, annual costs of such road and area of land rendered accessible.

Of the 27 companies which replied to this question, all except eight maintain some all-weather road, in part for purposes of management although accessibility for harvesting operations is doubtless the primary objective. For a total mileage of 5,338 miles an area of 20,418,000 acres was made accessible. On the average this means that for every six square miles of area classified as accessible there is one mile of road. Therefore, on the average, no accessible area is more than three miles from a main road. The total area of the limits of these companies is 30,106,000 acres which means that approximately 52 per cent of the licensed areas of these companies may be classified as accessible, as the term is applied in industry.

Eleven companies reported 4,583 miles of road maintained at an annual cost of $738,000 of an average cost of $161.00 per mile.

2. (b) (vi) Other management operations. Type of work done, annual cost and acreage treated.

Nineteen companies reported that, in addition to the items mentioned in 2(b) (i) to (v) above, they were carrying on operations which were calculated to provide for better management in the future. These included the following:

Experimental Operations	*Production Operations*
Experimental planting	Nurseries
Growth and yield plots (1710 plots reported)	Tree farms
Cull studies	Direct seeding
Hardwood girdling for release of conifers	Insect control
Cutting experiments	Seed spotting or brush scattering
Soil fertilization experiments	Scarification of cut-over land
Experimental study areas	Aerial spraying with herbicides
	Efficiency of utilization surveys
	Cut surveys
	Agreements with holders of private land
	Regeneration surveys

For a few of these projects per acre cost were available.

Aerial spraying with herbicides	$ 6.00 per acre
Scarification of cutover land	$13.00 per acre
Brush scattering on prepared area	$13.30 per acre
Experimental partial cutting	$ 4.00 per acre.

Milling Aspects (answered by pulp and paper companies only).

1. The use of sawmill residue in the manufacture of pulp and/or paper.

(a) Do you use any sawmill residue in your pulp and/or paper manufacture? Of the 23 replies made to this question, 13 were in the affirmative.

1. (b) If sawmill residue is being used now or is to be used in the future—

(i) When was it first used on a commercial scale?

While one company made use of chips as early as 1930, extensive use commenced in the late 1940's and early 1950's.

1. (b) (ii) What has been the pattern of utilization, i.e. what has been the change in volume of utilization of such residue since it was first introduced?

The pattern of use of chips has been one of steady increase with respect to the number of

mills using the chips as well as the quantity of chips utilized.

1. (b) (iii) Do you plan on using sawmill residue in your operations in the future to a greater extend than at present?

Most of the companies now using chips, and some of those that are not at present, indicated that they had plans for the extensive utilization of chips in the future. Many indicated that the extent of utilization would depend on the availability of the chips and their cost.

2. Changes in species utilization.

(a) In the production of the same product by essentially the same process, i.e. sulphate, sulphite, groundwood, etc., has improved technology made it possible for you to make use of formerly unused species of wood?

Thirteen of the 23 replies to this question indicated an increasing use of formerly unused or little used species over the past few years in the same process for the same or a similar product. It is of interest to note that at least one mill is using from 25 to 35 per cent poplar groundwood in newsprint with jack pine occasionally substituted for the poplar.

2. (b) Do you contemplate modifying existing processes to make greater use of formerly unused or little used species?

Fifteen of the 22 companies replying to this question indicated that some change in process was contemplated. At one mill, semi-chemical pulp made from hardwoods provides part of the chemical fibre for newsprint. It is reported that in one company in the United States cold caustic pulp is used up to 15 per cent for news furnish and another plant is producing newsprint wholly from mixed hardwoods. In other countries, notably Japan, semi-chemical pulp is being used for newsprint.

3. Changes in pulp yield per unit of wood volume for similar material due to improvements in pulp making technology.

(a) In any segment of your pulp making operation do you attain an improved yield of pulp for the same species using the same general process due to technological advances?

Of the 18 companies replying to this question, 12 indicated an increasing yield.

3. (b) If so, what process(es) are involved and what percentage improvement in yield do you observe?

Five of the companies contemplated use of the high yield sulphite or were already using this process. Some small increase in groundwood recovery was indicated but this is quite inconsequential from the point of view of reduced wood consumption.

3. (c) Do you plan to make greater use of the high-yield pulping methods in the future and if so what improvement in yield do you anticipate in the next 20 years?

Fifteen of the 19 companies replying to this question indicated their intention to make greater use of the high-yield pulping methods in the future. The increase in recovery was related to the process to be employed but most companies were optimistic about appreciable increases in yield in the future except for groundwood pulp.

Using the Forest for Many Purposes

G. Tunstell,
Member, Eastern Rockies Conservation Board, Ottawa

The forest is much more than an accumulation of raw material for forest industries. It is a dynamic complex which provides shelter for fish, game, and fur-bearing animals; regulates stream flow; covers underground wealth; sometimes provides fodder for cattle; and always provides relaxation and pleasure for untold numbers of Canadian and foreign recreationists.

A generation or so ago, there was so much forest in Canada and so little demand for it except by the wood-using industries that the interests of all could be accommodated with an easy informality. There was multiple use *of this resource, but no one would have recognized it by such a term.*

The situation has now changed drastically, and the change is just beginning to gather real momentum. The need for planned integration of all the demands made upon the forest is becoming increasingly imperative. The welfare of the forest industries—a cornerstone of our economy—must of course, be safeguarded. But the legitimate demands of a growing flood of recreationists must also be met. Our rivers must be preserved; underground wealth must be developed; agriculture must be allowed to spread into presently forested areas which are genuinely suited for this purpose; and our fish and wildlife resources must be enabled to resist the many pressures that advancing civilization is placing on them.

All this calls for elaborate planning. But even before that can be done, we must re-examine many of our orthodox *ideas and practices, including some time-honored concepts of the* rights *of ownership, occupancy, and freedom of movement.*

A small handful of multiple-use projects are shedding some useful light on the way to resolve these conflicting pressures. Experience suggests they cannot all be given equal weight. Under any given set of local circumstances, one forest use must be conceded dominance. Plans for all land and forest uses cannot be left to interdepartmental committees. New agencies or new approaches are required for effective coordination, and the establishment of parliamentary and legislative committees to study this problem should be encouraged.

Wood, in its many forms, is only one of several values derived from the forest. The well-worn saying about *not being able to see the forest for the trees* may aptly be applied to those who see in the forest nothing more than raw material for industry. To accept such a narrow view as a basis for resources management would be sheer folly. Forest resources by virtue of their vastness, versatility and complexity call for management skills operating within the framework of a broad range of social objectives wherein the forest can often be best utilized by remaining uncut or undercut. What constitutes the *best* manner or rate of its exploitation is governed not only by biological and economic factors but also by social and political considerations.

The *forest* itself is much more than a haphazard aggregation of trees. The extent and composition of our forests is governed by climatic factors and soil conditions. Some regions, such as the tops of the high mountains in the West and the northern part of Canada, are too cold; others like the southern portion of the Prairie Provinces are too dry, while in many areas there is too much bare rock or too thin a soil mantle to support a forest. Over the extensive regions of Canada where forests prevail the complex of climatic and soil factors varies greatly so that there are a great many types of forest, each with its own characteristics.

Any forest type is a complex community of shrubs, grasses, herbs, mosses, lichens and other plants,

living together and competing with each other for existence. There are some forest animals which feed on the vegetation, and others which are carnivorous. There are birds and insects which feed on the vegetation, the animals, or on each other. There are fungi and bacteria which convert the dead wood and leaf litter to humus. All these plant and animal forms are just as much a part of the forest as the trees themselves. Many of them are of primary importance and others are significant for their indirect benefits.

The forest canopy is often broken by lakes and rivers, open bogs, hay meadows, shrubs and grasslands. Each of these has its own environment and complement of wildlife. Whether or not these openings are regarded as part of the forest makes little difference. Where they occur, they must be managed along with the whole complex and so are very much a part of *forestry.*

The Status of Forests in Land-Use Policy.

Growing populations and a developing economy bring an increased and changing demand for land for many purposes. Conflicts of interests are likely to arise as, for example, between forestry and agriculture. Both are engaged in growing crops, but there is a vast difference in the time required to bring these crops to maturity. Most agricultural crops are produced in one growing season, whereas the growing of wood may require 80 to 100 years or for certain products even a longer period, to become commercially useful. Because of the time element involved, the growing of trees cannot be carried on under an unstable land-use policy.

To avoid the tragedy of settlers struggling vainly for years to grow farm crops on unsuitable land, examination should be made of all wildlands being considered for agricultural development. Agricultural settlement policies involve the consideration of more factors than simply that of soil fertility. Each new agricultural development should be large enough to justify the establishment of community amenities such as schools, churches, roads, communication systems and other improvements now considered basic to our modern concepts of living. The Federal Minister of Forestry, The Honorable H.J. Flemming has put it well in a statement before the Senate Land Use Committee: "Policies of land use", he said, "should not be conceived as narrow choices between agriculture and forestry, or between forestry and recreation, but should be directed to the provision of the optimum habitat for man" (—*Special Committee on Land Use in Canada,* Minutes of Proceedings, 4th Session, 24th Parliament, 9-10 Elizabeth II, 1960-61, No. 3, February 23, 1961).

Bearing this social dimension in mind, land-use surveys are needed for the new and the already-developed areas to ensure better use of the land and to correct mistakes of the past. Going beyond this stage in land-use planning, there is the policy for assuring a consistent development of the land and water resources of a region. An example of this kind of planning may be seen in Ontario, where the Department of Planning and Development (now the Department of Commerce and Development) has examined a number of drainage basins in the older parts of the province and has assisted in setting up Conservation Authorities to administer comprehensive plans. In most cases action was initiated because of the need for flood control. Not only have dams been constructed to regulate stream flow, but proper consideration has been given to the best use of land, and as a result a substantial acreage is being reforested as one of the means of controlling run-off.

As our knowledge grows and our experiences accumulate we appreciate more fully the fact that there is no inevitability of conflict in land use, and that indeed there is great scope for a range of complementary uses. The cultivation of small patches of arable land in the forest is generally unwise, but the reverse practice of maintaining or establishing a forest on the poor or marginal lands in an agricultural area is highly desirable. The woodlot is an important adjunct to many a farm. Such woodlots are usually close to market and often enjoy a more favorable climate than most forests. They are capable of producing a high yield of wood but, generally speaking, they are poorly managed. This is, however, a man-made situation and can be remedied, as it largely stems from a lack of knowledge of the rudiments of forestry and from the desire or need for immediate income in preference to a larger but delayed return. So far as it is a problem common to most farms in a given region, the solution is most likely to be found through a land-use survey and planning with its related programming which foster multiple-use concepts and practices.

Multiple-Use Forest Management

Increases in population always give rise to greater or new demands on forest land, particularly in the more accessible areas. This factor, coupled with improved transportation and increased leisure, is the reason why multiple use is much more important today than ever before.

Multiple use of forest land is simply the utilization of the forest resource for two or more purposes such as production of wood, recreation, grazing, wildlife, and the control of run-off. It is the usual practice on most areas, even on those for which it is not definitely planned.

As most of the forests in Canada are Crown property, decisions as to how they shall be used rest with various governments. There is no general rule to apply in making these decisions because forest resources differ from one area to another and public needs vary from place to place, over a period of time. The objective is to secure maximum benefit in meeting commercial and social needs.

The decision as to what use shall be made of forest on private lands will be made by the owner, subject to such legal limitations as are necessary to protect other property owners, or the public at large, against damage through misuse.

On most of these lands, the production of wood crops will supplement other sources of income. There are, however, other uses for privately-owned forests. For example, because of its location in relation to centers of population, and particularly if it has special scenic values, it might be profitable to open the forest to the public for recreational purposes on a fee basis.

Where a forest area is used for two or more purposes, decisions as to their relative importance must be made. The forest manager, taking instructions or guidance from the owner, should understand the objectives of management. He should try to foresee the conflicts which may arise and adjust management plans so that these may be avoided, or at least, reduced to a minimum. He should safeguard the main objectives, but within that limitation should take full advantage of the other resource values.

One outstanding example of a multiple-use forest area is that administered by the Eastern Rockies Forest Conservation Board under the terms of an agreement between Canada and the Province of Alberta. This area of 9,000 square miles lies to the east of Banff National Park. It is partly in the foothills and partly in the mountains. Together with Banff Park, it embraces most of the headwaters of the Saskatchewan River. These headwater areas, above the 4,000-foot level, are somewhat less than 20 per cent of the drainage basin, but account for over 80 per cent of the stream flow.

The policy for this conservation area is to utilize all the forest resources, making such adjustments to usual management practices as are deemed necessary to ensure optimum yields of water. Its work in reconciling different uses of the watershed area under its jurisdiction would be instructive. Accordingly it is pertinent to make reference to this experience in relation to the various uses of forest land which are considered below. It is, at any rate, the case with which the author is most familiar from a great many years of involvement.

Recreation

More people with longer vacations, more leisure time at week-ends and better means of travel are making more demands for outdoor recreation. The forests of Canada have a vital role to play in this regard.

Parks established at the national, provincial, municipal and private levels meet this demand in part only. Most outdoor recreation is for fishing, hunting and sightseeing. Hunting is prohibited in parks; fish recognize no boundaries; the parks contain only a fraction of the scenic spots. Then too, many of these parks are too remote for the convenience of a large segment of the population. For these and other reasons, there are more people seeking recreation in forested areas outside parks than in them. This influx of visitors poses a problem in forest administration.

The private owner can prohibit trespassing. The lessee of Crown lands, acquired for wood supplies, might have the right to close his roads to public travel. Such action, however, would impair public relations and contravene the policy of most companies. On unalienated Crown lands the public is free to camp, hunt, fish, etc., subject of course to laws or regulations governing such activities.

The forest manager is greatly concerned over the increased risk of forest fires which tourists create. Most people are careful and considerate, but unfortunately there are a few who are grossly uninformed or indifferent. Most forest managers agree that exclusion of the public from the forest is not the answer to the problem. They are prepared to meet the situation by strengthening their fire-protection organizations and by educating the visitors to both the responsibilities and privileges of forest travel. Many operators go to the expense of building fireplaces and providing picnic tables at popular points. These, if not naturally safe against the spread of fire, are provided with special safeguards.

People generally respond to good treatment and if public relations are good, it will be found that the well-behaved majority will have a restraining influence on the irresponsible element.

Forest closure during periods of high fire danger is a generally accepted practice, and so long as authori-

ty for closure is used intelligently, the public understands and accepts this necessary restriction.

There are some forest roads which should not be open to the public because of the high risk of accidents with logging trucks or other equipment used on forest operations. Other roads are built to very low standards as fire trails, and their use by the public would soon make them impassable and useless for their intended purpose. The public has little objection to such closures so long as the reasons for closure are valid and properly explained.

With the foregoing qualifications and aside from the additional risk of forest fires, the use of the forest for recreation does not seriously interfere with the production and harvesting of wood.

Many of the National Parks are forested, but present policy prohibits the cutting of timber, on the grounds that logging is incompatible with recreation. This is a debatable point, particularly since 99 per cent of tourist travel is along well-constructed highways and there are vast undeveloped areas not near a highway. Moreover, trees after reaching maturity become decadent and fall prey to insects and fungi. Is such waste of timber values necessary? Should stands of trees be allowed to reach over-maturity with the certainty that insects and fungi will destroy them? Also, in such stands, the build-up of disease and injurious forest insects may reach epidemic levels, may spread to other areas—perhaps beyond the park borders—attacking healthy and immature stands which may belong to other people.

In a park, recreational use must receive top priority, but this hardly justifies letting other forest values go to waste without making an effort to work out practices which would make their utilization fit in, with little or no sacrifice to recreational pursuits.

On the Eastern Rockies Forest Conservation Area recreational activities have shown a marked increase in recent years. A system of self-registration for people entering the area was introduced a few years ago. In the year ending March 31, 1957, the number of people entering the area was 138,006: the comparable figure in 1960 was 207,368. This shows an increase of 50 per cent in only three years. It is believed that this registration system makes each tourist conscious of his privileges and responsibilities, and his reaction in the use of open fires has been quite satisfactory.

Recreational activities on this conservation area have not interfered with other uses to any appreciable extent. The cutting of timber and the grazing of cattle are two uses which are not allowed on areas developed for picnicking or camping, but the total of such areas is relatively insignificant.

Watershed Management

In most places, the supply of water of good quality in sufficient quantity is too often taken for granted. This is not the case in some parts of the West where dry land farming is practised to conserve moisture and where industrial growth is hampered by an inadequate supply of water.

The forest plays an important role in relation to water supplies and stream control. It does not prevent floods, but it usually reduces their severity by delaying snow-melt until water from the open areas has passed down stream. Moreover, under forest cover, frost does not penetrate so deep or form such a continuous *pavement* as in the open. More water is thus permitted to infiltrate into the soil and surface flow is thereby reduced.

Little or no bare ground is exposed in the forest. The soil is covered by a litter of leaves and twigs which are broken down by fungi and bacteria to form humus. Herbaceous plants or mosses, under the existing environment, might form a continuous carpet.

Forest soils are protected against the impact of rain drops—there is no splash effect. The insulating blanket of plants, litter and humus can hold several times its own weight of water which is filtered into the soil. This filtered water does not clog the pore spaces, so that soils remain permeable and infiltration rates high.

Surface run-off of water to streams occurs during snow melt and during rainstorms, when the rate of precipitation exceeds that of infiltration. However, as the infiltration rate is high under forest conditions, this does not happen very often. Surface run-off also occurs if the soil is saturated with moisture.

Streams from a forest area are ordinarily quite clear because there is practically no surface flow of water to cause surface erosion. Some sediment load is normal during the spring run-off and some streams are subject to channel erosion.

All soils can serve as temporary reservoirs of water. Very large quantities of water can be stored in this way, some of it held against the pull of gravity and used by the vegetation. The remainder moves either downward to replenish ground water supplies or laterally through the soil to springs and stream channels. Because of this location at the headwaters of streams, forested soil is of special importance in this respect.

Some forest areas may be more valuable for their yield of water than for their timber yield. For example,

this is the case in the Eastern Rockies Forest Conservation Area, where precipitation is relatively high and at least half of it is in the form of snow. At high elevations, the cool air retards the completion of the snow melt until late in the summer. Water from this and adjoining headwater areas maintains the flow of the Saskatchewan River, the south branch of which traverses one of the driest areas in Canada.

Even though water yields take precedence over timber production in this area, the two objectives are not incompatible. However, to safeguard the water resource, logging is subject to some special regulations. For example, drainage along logging roads must be diverted to safe places to prevent erosion and too rapid run-off, and when roads and log landings have served their purpose, they must be seeded to grass or other suitable vegetation to protect the soil and improve water infiltration. When logging is conducted close to watercourses, only marked trees may be cut along stream banks and all logging debris must be kept out of the channels. Of course the skidding of logs along or across stream beds is prohibited.

In addition to the foregoing special regulations, it has been the policy to reserve high-elevation forests from cutting. In general, these are the forests above the 6,000-foot level.

Grazing

Grazing of domestic livestock is an important forest use in parts of British Columbia and Alberta where open grassland in the forest region is common. The use of the forage on these lands helps sustain beef and wool production, and removes excessive vegetation which could accumulate and become a flash fuel.

The grazing of domestic animals in stands of growing timber is not recommended as these two uses are seldom compatible. On one hand the tramping and browsing of cattle is detrimental to tree growth and, on the other, the tree cover inhibits good forage both as to quantity and quality. On land which can be used for either grazing or the production of timber, the owner should choose between the two.

Some species of wildlife use the forage to a certain extent. With deer, moose and elk the critical need is winter feed. There is always more than enough summer feed, and on wildlands it is only the surplus which should be made available to domestic stock. Game population levels, particularly of elk, must be watched carefully and kept in balance with the supply of winter feed. Failure to do so will result in the starvation of some, the undernourishment of the balance, and also in excessive damage to young growing trees and the ground cover in general.

Wherever the water supply is of critical importance, such as on the Eastern Rockies Forest Conservation Area, livestock grazing must be carefully controlled. Each grazing unit should be examined by an expert to determine the maximum number of animals it can carry without impairing good watershed conditions. The earliest date grazing may commence must be established so that the initial plant growth can be protected in the interest of better feeding later in the season. If tramping of cattle starts too early in the growing season when the soil is full of moisture the soil may become seriously compacted. This in turn can lead to poor infiltration and more surface run-off, with attendant erosion and sedimentation of streams.

Trapping

The trapping of wild animals is a very old, and still important, forest use. Although some of these animals may do damage to tree growth, such damage is offset by their beneficial activities. This is certainly true of the beaver.

Trapping is a winter occupation, so the risk of accidental fires is low. Some forest fires have occurred in the spring through the neglect of camp fires set on swamp ground by muskrat trappers. However, most trappers are ardent believers in forest fire protection, because forest fires over their trapline areas could result in the loss of their livelihood.

Fishing

Fishing in the lakes and streams of the forest is enjoyed by a great number of people. Injudicious forest management practices, such as carelessness in logging close to fishing streams and lakes, can result in poorer fishing. Cool, clear water is essential for some species of fish, particularly trout. Excessive and careless logging can result in both a rise in water temperature above a desirable level and an increase in the sediment load reaching the stream.

Along valuable fishing streams, care must be exercised in harvesting the tree crop. Logs must not be skidded across or along stream beds and slash must be kept out of stream channels. For a distance of 50 to 100 feet on each side of such a stream, cutting should be restricted to trees marked for removal by a person experienced in both forest and fish management.

Particular care must be taken to avoid damage to the spawning areas of all fish (including anadromous ones) in forest streams and lakes. In the past, logging caused damage to spawning grounds of salmon on both the east and west coasts of Canada. Education and revised logging regulations have gone far to improve the situation, but the problem is not yet solved.

In a multiple-use forest area, maximum benefit from fishing and wood production can be achieved. To do so requires only minor adjustments in forestry practices, and more precautions by fishermen to prevent forest fires caused by careless smoking or camping habits.

Conflicts with Sub-surface Rights

The search for, and development of, minerals and petroleum resources does sometimes conflict with the production of wood in a forest area.

Years ago, prospectors destroyed large areas of forest either deliberately or through carelessness with fire. Fortunately, methods of prospecting have changed and losses from this cause have been greatly reduced.

The bulldozing of roads and seismic lines through the forest as part of the search for gas and oil creates an increased fire hazard, no matter to what extent, if any, the slash is cleaned up.

Strip mining for coal and minerals may do some damage to forest growth, but it is localized. The danger of water pollution from such operations is a far more serious problem.

A vexing conflict occurs between mining and forestry in some provinces where the holder of the sub-surface rights *ipso facto* gains a measure of control of the surface rights. It is not unusual for several square miles of timber to be tied up with a mining lease and thus unavailable for inclusion in a timber license. It is questionable, to say the least, whether the lessee of the sub-surface rights needs such extensive rights in order to conduct his mining operations. This matter should receive serious consideration by governments leasing mineral rights on Crown lands.

Forest Access Roads

The importance of roads in opening up a forest area is well illustrated by the Eastern Rockies Forest Conservation Area. During the period 1947 to 1955 over $5 million were spent on the construction of roads. These roads made the resources of the area more accessible and consequently hastened their controlled exploitation. Annual revenues from surface rights give a clear indication of this development. Before 1947, they were roughly $100,000; in recent years they have averaged close to $550,000.

Roads provide one of the essential keys to full utilization of the forest. With no roads there is little or no use made of resources. With a limited number of roads there is partial utilization. For full development and proper management and protection of all the forest resource there must be access to the whole area.

The federal government, recognizing the importance of forest-access roads, has on two occasions made funds available to the provinces for road-building on a shared-cost basis. The first period was from January 2 to June 30, 1958 and the second from November 1, 1958 to June 30, 1959. "Forest Access Roads and Trails" agreements were made with eight of the ten provinces under the authority of the Canada Forestry Act.

Among other provisions, the federal government agreed to pay 50 per cent of construction costs, provided that not less than one-half of all expenditure was in payment of wages to persons employed on the project.

There was no stipulation as to the ownership or tenure of land on which projects could be carried out, but the projects had to be undertaken and paid for by a provincial government or by a recognized forest protection association. The maintenance of all roads and trails constructed under these agreements became a provincial responsibility.

Projects initiated under these agreements numbered 212 in the first period and 226 in the second. Federal disbursements to all provinces totaled almost $4,295,000 under these agreements.

Action required

The exploding demand for recreational areas, the rapidly growing interest in deposits of minerals and fuels, the phenomenal rate of recruitment to the *army* of hunters and anglers and, in some areas, the increasingly critical need for watershed protection, all make it abundantly clear that the forest industries are going to have to share their *wilderness* areas on a scale undreamed of a generation ago and perhaps only vaguely appreciated today. If we assume that all these independent demands can be accommodated without friction and problems, and without benefit of far-sighted policy backed by carefully planned management, we grossly deceive ourselves. A small start has been made in Canada to work out and apply multiple-use concepts of forest management based chiefly on safe-guarding the best, local, dominant use of the forest. However, we cannot dawdle over this problem. Not only will it be necessary to evolve new concepts of rights and privileges, but there is also a strong probability that some old and well-entrenched concepts will have to be uprooted.

Remembering that forestry is only one of several land uses and that each has its place in our social

and economic development, with careful planning, many of the mistakes which have been made in the past can be avoided and increased benefits obtained. But it is important to recognize that planning needs to be co-ordinated. The tendency in the past has been for each agency such as, agriculture, forestry, wildlife and recreation, to develop its own plan. What is needed today is a co-ordinated plan in which all uses are considered. To obtain this objective the broad planning for land use must be at a high government level. It cannot be left to one agency having responsibility in one resource field. Planning, to be successful, must be a co-operative effort.

As the provinces have control of their natural resources, each must plan its own development. However, each can gain much from the experience of the others and it would be advantageous to set up a national committee which would meet annually, or periodically, to exchange information. A national committee seems more desirable than an interprovincial one because of the federal responsibility for extensive areas in the northwest. Also the federal government should continue to co-operate with the provinces in land use development.

Opinions may differ as to how best to organize for most effective co-operation in land use planning. Certainly the various government departments or services concerned with land use must be brought together if well-co-ordinated plans, based on sound policies, are to evolve. However, each of these departments and services is so busy carrying out its day to day duties that there is a danger that this type of planning may not receive the attention it deserves. It is because of these day to day pressures that an interdepartmental committee may not be satisfactory.

The appointment of parliamentary and legislative committees would be highly desirable to study our land use problem. Such committees could call on the various government agencies for information and invite agencies outside government to participate. The problems of land use are of sufficient importance to be assessed at this level and there is the added advantage that their recommendations have not far to go to receive parliamentary authority. The job seems to present relatively few technical problems, but the legal, jurisdictional, educational, social, and psychological aspects may be formidable. In this situation time is not on our side; it is an ally of confusion.

Bibliography

Anderson, H.E. and G.A. James. *Watershed Management and Research on Salmon Streams of Southeastern Alaska*, 1957.

Canada. Dominion Bureau of Statistics. *Canada Year Book*, 1959. Queen's Printer. Ottawa

Coleman, E.A. *Vegetation and Watershed Management*, Ronald Press Co. New York. 1953.

Eastern Rockies Forest Conservation Board, *Annual Reports*, 1948 to 1960. Calgary.

Kittredge, J. *Forest Influences*, McGraw - Hill Book Co., Inc., New York. 1948.

McArdle, R.E. *The Concept of Multiple Use of Forest and Associated Lands*. Paper delivered at Fifth World Forestry Congress. Seattle, Washington. 1960.

United States. Department of Agriculture. *Water*, U.S. Department of Agriculture Year Book, 1955. Washington. D.C.

Survey and Assessment of Forest Management Practices on Public Lands

J. W. B. Sisam,
Dean, Faculty of Forestry,
University of Toronto,
Toronto, Ontario.

Although there are still large areas of natural forest in Canada which, to the extent they are economically accessible, will provide industrial wood for some years ahead, in most provinces the declared policy of government, whether expressed in legislation or not, is to manage the Crown forests on a sustained-yield basis in order to maintain the forest industries in a competitive position with respect to raw materials.

Essentially, sustained-yield management requires a background of forest reservation and adequate protection, together with regulation of timber harvest in relation to annual or periodic growth, efficient utilization of forest products, maintenance of soil productivity and production, and provision of detailed information on forest conditions through inventory surveys.

As these requirements have been recognized, changes have been made in administration procedures, and the legislative framework, devised in the first instance to facilitate the sale of timber prior to land settlement, has been adjusted to give the necessary control and regulation over forest operations. The progress that has been made varies in kind and degree from one province to another, depending on a number of factors, in particular to accessibility of the forest to stable markets, the level of technical knowledge available, trends in industrialization, and the influence of interested people, especially professional foresters.

Parallel with these developments and as a result of increasing population and an expanding tourist industry, there is a growing demand and need for forest land to provide for recreational and other related uses, all of which are not necessarily compatible with timber production. To help meet these various pressures on land use, concepts have been developed, based on priority rating or integration (multiple-use) which are functional in their intent and require careful evaluation for their successful use. Increasingly, as these pressures on land grow, success in the administration of Crown forests will depend on the rationalization of all factors involved – political, technical, social, and economic.

In Canada, there are still vast areas of uncut natural forest in public ownership; these will provide the main supply of industrial wood for some time to come as long as their cost of operation, in terms mainly of harvesting and transport, does not become prohibitive. In nearly all provinces[1] forest administration has been, and still is closely involved with the exploitation of these forests. In this process, the *basic* interest of government is the disposal of standing timber at a price that will provide a net income for the public treasury,[2] and to this end the encouragement of the wood-based industries; for industry, the *basic* interest is an assured supply of standing timber at a reasonable cost over a sufficiently long period to justify capital investment in plant and equipment.

In the meantime, in recognition that the forests will contribute to our economy in perpetuity, if properly cared for, there is gradually developing under legislative authority, more quickly in some parts of the country than others, a pattern of management, aimed primarily at ensuring in the future high yields of useful timber in the more productive and accessible areas of Crown forest.

During the period of transition from exploitation to management, government will be subject to demands and pressures which have to be rationalized with respect to overall and long-term benefits.

In the present paper, consideration is given to current legislation [see Appendix I] and related programs of protection and management of the Crown

lands and Crown forests[3] in the different provinces and territories; both legislation and programs are subject to constant review and amendment, partly to make use of new knowledge as it becomes available, partly as a result of the recommendations of investigating committees,[4] and partly owing to the pressures that develop in relation to the use of public land as populations expand.

Sustained Yield as an Objective of Forest Policy

In nearly all provinces, the declared aim of government, whether provided for in legislation or not, is to manage the Crown forests on a sustained yield basis. While this approach to management received a good deal of attention during the 1920's and 1930's, mainly as a result of the rapid expansion of the pulp and paper industry and the urging of a growing body of professional foresters, and gained some expression in a preliminary way through the introduction of provisional working plans, the establishment of forest reserves, and the passing of what might be termed "exploratory legislation,"[5] it was not until after 1945 that support was sufficient to provide both legislative and administrative authority for its undertaking. In the period 1945 to 1950, largely as a result of wartime recommendations for economic reconstruction and a postwar industrial boom, the forest resources and their administration in a number of provinces were investigated by government-appointed committees and commissions; in all cases these bodies strongly recommended the development and implementation as rapidly as possible of management processes that would ensure a perpetual or sustained yield of forest products.[6] Today this principle is gradually being incorporated in the legislation and administrative processes of all authorities responsible for the Crown forests in Canada.

As defined in the 1945 report of the British Columbia Royal Commission on Forestry, sustained yield means "a perpetual yield of wood of commercially useable quality from regional areas in yearly or periodic quantities of equal or increasing volume." In contrast to straight exploitation or what has often been referred to as the "cut out and get out" process, sustained-yield management views the forest as a production unit which, by making proper use of the soil and other factors of the environment, will provide a continuous supply of wood products at a predetermined level. Four basic requirements for efficient operation are: (a) the protection of the unit from serious damage or destruction; (b) equating the allowable cut, on an annual or periodic basis, to the increment; (c) complete use of the allowable cut as it becomes mature; and (d) maintenance of production by adequate replacement of the timber removed.

While sustained-yield forest management is stated as being a common objective of most government authorities, the level of development and application varies widely between provinces and, perhaps more significantly, between regions, depending primarily on the accessibility of the forest to a market or markets that will use its products on a continuing and profitable basis.

Other factors important in determining the kind and level of management for any region will include: (i) the past history of forest administration (at least of temporary significance); (ii) information available on the forests and forest industries; (iii) qualification and experience of those responsible for planning and control; (iv) pressures on the forest for other uses; and (v) the dual responsibility of government and industry in administering and operating the resource. Further reference to some of these points will be made later in the presentation.

Present Levels of Management Planning and Control on Crown Forests

At the time of Confederation, full jurisdiction was given to the provinces (Nova Scotia, New Brunswick, Quebec, and Ontario), through the British North America Act [92 (5)], over "the management and sale of public lands and the timber and wood thereon." Since that time, similar authority has been given the other provinces, either at the time they attained provincial status or subsequently,[7] so that today all of the Crown land within provincial boundaries is administered under legislative authority by provincial governments with the exception of relatively small areas under the federal Government for use as national parks, Indian reservations, and research centres. The distribution by ownership of productive forest land in Canada by provinces and territories is shown in Table 1. From this it will be seen that with the exception of Nova Scotia, and to a smaller degree New Brunswick, the bulk of the forest land in Canada has been retained in the title of the Crown.

In the following discussion, different aspects of forestry are treated separately, this being justified on the grounds that forestry developed in this country in a piece-meal fashion, each phase being recognized and dealt with by rule and regulation as the associated problems came to the fore; only gradually and in a few places is forestry as yet looked upon and practised as an integrated science.

Forest Protection and Reservation

Under the forest conditions in this country (eastern Canada in particular) during the latter half of the nineteenth century, these two matters – protection

Table 1. Forest Land Classification by Provinces and Territories
(in square miles with percentages in brackets)

	Land Area	Forested Land	Productive Forest Land		Occupied Forest Land			Unoccup. For. Land		Total Productive Forest Land
			Accessible	Potentially Accessible	Provincial Crown	Federal Crown	Privately Owned	Provincial Crown	Federal Crown	
Newfoundland										
Labrador	101,881	64,998	14,427	3,320	8,489 (48)	—	—	9,258 (52)	—	17,747
Island	41,164	18,773	12,485	273	6,416 (50)	—	2,062 (16)	4,280 (34)	—	12,758
P.E.I.	2,184	544	544	—	—	3 (1)	541 (99)	—	—	544
Nova Scotia	20,402	16,223	15,106	—	702 (5)	34 (—)	11,798 (78)	2,572 (17)	—	15,106
New Brunswick	27,835	24,329	23,808	—	10,855 (45)	414 (2)	12,539 (53)	—	—	23,808
Quebec	523,860	378,012	134,160	86,112	62,020 (28)	227 (1)	21,841 (10)	136,184 (61)	—	220,272
Ontario	344,092	261,747	130,633	35,108	82,539 (50)	1,269 (1)	16,191 (10)	65,742 (39)	—	165,741
Manitoba	211,775	123,305	37,245	21,422	2,544 (4)	355 (1)	4,278 (7)	50,531 (86)	959 (2)	58,667
Saskatchewan	220,182	117,737	25,503	15,505	2,612 (6)	592 (1)	5,830 (14)	30,769 (76)	1,295 (3)	41,008
Alberta	248,800	158,530	111,628	3,809	6,100 (5)	330 (—)	4,436 (4)	98,104 (85)	6,467 (6)	115,437
B.C.	359,279	267,637	183,500	24,911	6,178 (3)	811 (—)	10,287 (5)	191,025 (92)	109 (—)	208,411
Provincial Total	2,101,454	1,431,837	689,037	190,461	—	—	—	—	—	—
N.W.T.	1,253,438	194,600	11,700	21,900	—	11 (—)	—	—	33,589 (100)	33,600
Yukon	205,346	81,200	14,200	27,900	—	16 (—)	—	—	42,084 (100)	42,100
Canada	3,560,238	1,707,637	714,937	240,261	188,454 (20)	4,061 (1)	89,803 (9)	588,466 (61)	84,414 (9)	955,198

and reservation – required attention before any form of management could be contemplated. They are brought together in this text because of their early coincidence, because they are important no matter what use is to be made of the forest – whether timber production, recreation, or water conservation, and because in a number of instances they are treated legislatively and administratively as separate from other phases of forest management.

Protection. The various acts respecting fire protection follow much the same pattern from province to province, the principal objectives in all cases being first to limit the chance of fires starting, second to develop efficient means of fire control, and third to establish responsibility for the incidence of fires. To these ends, most fire legislation gives authority to the Minister or his representative: (a) to declare a period of time (e.g., April 15 to October 15) as a fire season, during which land clearance and slash fires cannot be started without permission; (b) to close for a period any forest area so that it may not be entered without a *travel permit;* (c) to require that all those operating on Crown lands have a *work permit* before starting operations in any year. In most cases these acts set out the responsibilities of forest and mill operators to provide adequate fire-fighting equipment and to train and use their employees to control and extinguish fires on property for which they are responsible, and also place on the operator the onus of clearing himself from responsibility for fires starting in the vicinity of operations under his control.

In Ontario, where summer logging is becoming a regular feature of forest operations, and where the forest also is becoming more widely used by the general public, the Forest Fires Prevention Act was amended in 1959 to authorize *agreements* between the Minister and Crown land licensees whereby allocation of the costs for controlling and extinguishing fires may be determined in relation to local conditions.

While provincial governments have an over-all responsibility for fire protection on Crown lands, the organization and administration of protection on licensed areas may be handled either by the provincial authorities (as in New Brunswick and Ontario) with licensees being required to pay an annual fire protection tax, or, as in Quebec, by regional protection associations of limit holders, or by individual licensees. In Newfoundland, a Forest Protection Association, organized mainly for fire detection, is sponsored and supported by the two main limit holders and the provincial government.

In a number of cases provinces have entered into *agreement* with the federal government under authority of the Canada Forestry Act (and more recently the Department of Forestry Act), whereby Canada agrees to provide to the province, subject to the limitations and provisions of the agreement:

> "(a) Fifty per cent of the costs of equipment for forest fire prevention, detection, and suppression, forest protection, communication, and transportation, erecting buildings to be used primarily for forest fire protection, and the chartering or employment of aircraft or vessels not owned by the province for forest fire protection and (b) twenty-five per cent of the costs of the erection of buildings primarily used for other purposes, but used in part for forest fire protection, and the construction of forest access roads, trails, bridges, and dams required for forest fire protection."

Timber losses through insects and disease may be even larger than those from fire, especially in extensive overmature forests. Much of the work in this area is in the nature of research being undertaken by the federal Division of Biology in co-operation, under agreement, with various provincial governments, the results being applied where possible through operational prescriptions. Over the past five years, a program has been developed under *agreement* between the federal and provincial governments and forest industry in New Brunswick and the provincial government and industry in Quebec, with the aim of establishing control over the epidemic outbreak of spruce budworm in New Brunswick and Quebec through spraying.

Reservation. In eastern Canada during the latter part of the last century, as pressures increased on the more accessible land areas for the removal of forest cover, both to provide logs for the lumberman and land for the settler, the need for forest reservation was considered almost as urgent as fire protection, and legislation and administrative procedures to deal with both these problems came into being almost simultaneously.

Although assurance of future supplies of timber has been the main reason for reserving Crown lands, there have also been areas set aside for the protection of soil and water resources[8] and, of increasing significance, for the provision of recreational facilities; parks authorities associated with forest services have been established in many provinces, the most recent being in Nova Scotia in 1959.

To many people, especially those interested in the non-timber values of the forest, protection and reservation represent the essence of conservation, and logging is often associated in their minds with wasteful practice and depreciation of the values they are concerned with; there has undoubtedly been much evidence to support both these views. However, in the practice of forest management on a sustained yield basis, the essential importance of protection and reservation is in stabilizing the resource and giv-

ing some assurance of a production unit that will support such a program in perpetuity. Thus the passing of the Forest Reserve Act in Ontario (1898), which caused the withdrawal from settlement of 16,395 square miles of forest, was viewed at the time as the first step being taken by the provincial government "in preparing for a rational system of forest management." Subsequently in the Ontario Provincial Forests Act (which replaced the Forest Reserves Act in 1929) provision was made for a department officer "whose duty it will be under the Minister of Lands and Forests to preserve the said forests according to the best forest practice and to gradually bring them under a sustained yield basis." Today, while provision is made in a paragraph of the Crown Timber Act for the reservation of the Provincial Forests, this matter has relatively little significance, as these forests are now incorporated in sustained-yield management-units.

Similarly in British Columbia under the Forest Act (1912) provincial forest reserves were established, both to prevent further alienation of Crown lands and to place control under the Minister "for the growing of successive timber crops." Subsequently, when the Forest Act was amended in 1925 with the object of initiating a management program in the reserves (through the establishment of a Forest Reserve Account), the Minister at that time stated that "the setting aside of forest reserves is the foundation of a sound forest policy and the primary object of their creation is to ensure a continuous production of timber." As in Ontario, so in British Columbia, the process was gradual and culminated in the incorporation of the reserves in public management units or working circles.

In some other provinces, as management programs are being developed, timber reserves are important in providing the base for any future expansion of the wood-using industries; in some cases, all unalienated Crown land is classed as "forest reserve" in the first instance with provision in legislation for the withdrawal of such land from reserve as may be required for other types of public use or as may be found better suited to some other form of development. In addition to forest reserves for industrial use, there are sometimes areas set aside, such as the "township reserves" in Quebec, to provide small cuts of timber for the local residents.

Timber Disposal and Forest Management

With the bulk of the productive forest land in the title of the Crown, the responsibility for developing management processes rests largely with government. Today in nearly all provinces and territories, the principal method of disposing of Crown timber is by sealed tender or public auction, based on an upset price of so much per unit area (Quebec and New Brunswick) or per unit volume of wood, the sale usually (but not invariably) going to the highest bidder. A licence or permit is issued which allows the cutting and removal of timber, usually over a specified period of time (originally one year) and often with renewals thereof, provided government charges are paid and the terms of the licence and relevant regulations are observed. These are increasingly associated with the objectives of sustained-yield management.

In this process, we see an attempt to fit the requirements of management into an administrative framework that was developed originally for a quite different purpose – that of disposing of timber to provide revenue for government prior to making the land available for settlement and agricultural development.

With the opening up of new country and the expansion of the pulp and paper industry, licences for the right to cut timber have tended to be for a period of years: the length of time varies considerably by provinces and industries, the term of the licence and the amount of wood thus made available being more or less related to the requirements of a mill of approved capacity during the period of its amortization. Associated with this aspect is the requirement that all, or a high percentage, of the wood cut under the licence be manufactured either in Canada or in the province in question. In Quebec, while all licences remain on an annual basis, their renewal for established industries is automatic if the regulations are adhered to. In Ontario, a somewhat different approach to meeting the needs of the pulp and paper industry was developed whereby the granting of cutting rights by special agreement was instituted. These pulpwood concession agreements (now included within the term "licence") provide companies with cutting rights over specific areas for a period of years, or longer by extension.

At their inception at least, the longer licences and agreements had no definite relationship with sustained-yield management; rather they provided a means for encouraging the establishment of industry and ensuring the disposal of large volumes of mature wood with a commensurate revenue to government. As a further stage in the gradual process of administrative evolution that is taking place, it is probably true to say that, as the demand for timber has increased and the need for rationalizing forest management has become more apparent, governments have tended to incorporate the requirements of management into the framework of timber disposal as it had developed under a system of forest liquidation; only gradually is it coming to be recognized that the two are not necessarily compatible. One factor that pro-

bably favored the pattern as it developed was the fact that while forest services became established in many of the provinces, their responsibilities in the beginning were confined to reservation, protection, and survey, the disposal of timber continuing for many years to be the function of the Commissioners of Crown lands. The first instance of a chief forester being appointed in charge of all forest conservation, protection, *and* utilization activities was in British Columbia under the Forest Act of 1912, and it is in that province, as much as any, that the main effort has been made to establish an administrative procedure through and within which sustained-yield management might best develop.

Inventory Survey. A prerequisite for any kind or degree of management is the provision of information, first on a general province-wide basis, and second in some detail for each area or unit of production, with respect to such matters as timber volumes by species and age classes, growth rates, the incidence of defect, and so on. The method and means of doing this has been a subject of constant concern and various degrees of success for the past 50 years.

Since 1945, inventory surveys have been undertaken in most provinces, making use of up-to-date aerial photographic equipment and techniques. Some provinces have entered into *agreement* with the federal government, under authority of the Department of Forestry Act (and earlier the Canada Forestry Act) whereby, the provinces are to complete and maintain forest resource inventories with Canada contributing 50 per cent of the costs. In a number of cases, the results of these surveys have been published.

In those provinces where management plans are required for commercial operations, a detailed inventory survey of the limit must be completed, often at the expense of the licensee, although on small licences this work may be done by the forest service without charge as, for example, in New Brunswick.

Cut Control. Control or limitation on cutting operations was first instituted in connection with the sawlog industry by establishing a diameter limit, varied according to species, below which no trees could be cut; the purpose was to prevent the removal of immature trees for sawtimber. This method was first adopted in Ontario in 1871 and subsequently in other eastern provinces. To a limited extent it is still used across Canada in connection with sawtimber operations.

Diameter-limit control does not, of course, allow for the considerable variation in size of mature trees within some species and in relation to growing conditions, or in susceptibility to windthrow – features that were brought to the fore with the development of the pulp and paper industry and its use of species that are often characterized by slow growth, relatively small size, and shallow root systems (e.g. black spruce). To meet this situation, procedures were introduced in New Brunswick (under-size permit) and Quebec (cutting by exception) whereby the licensee could be granted permission to cut timber in sizes below the diameter limit if the situtation so warranted.

Gradually, as information on timber volumes and growth rates became available, governments have increasingly required licensees to establish control of their cutting operations and relate these to growth potential through long-term management plans supplemented by annual reports and plans for current operations.

The first step in this direction was taken in Quebec in 1921 when the government required that licensed lands be inventoried at the expense of the licensees and that growth studies be undertaken to determine the allowable cut. By 1923 a number of timber limits were first placed under tentative management plans, with the aim of controlling the annual cut to no more than the annual increment. Today, in order to gain authorization to "cut by exception" the licensee must make application to the Minister of Lands and Forests and submit a management plan based on a proper inventory made according to the instructions of the Minister. Furthermore, in addition to a general plan for the area under licence, the licensee must furnish a special working plan for the portion to be operated during the first decade; the quantity of wood to be cut during this period may not exceed the estimated growth "except where it shall be judged opportune to regularize the forest stock." There is established a joint responsibility for the licensee and a representative of the Forest Service to examine areas to be cut and "to choose from the silvicultural treatments prescribed in the working plan the one which should preferably be applied in each case."

To cite another example, in British Columbia on a Tree Farm Licence (which represents a long-term agreement for the sustained yield management of an area), planning and control are carried out through management plans and cutting permits, the former providing all relevant information and setting out the forest activities to be undertaken on the area over a specified period of time and the latter giving authority for all cutting operations on an annual basis. It is stipulated that the annual cut on such a licence must not be more than 50 per cent above or below the allowable annual cut, and over a five-year period the cut must be within plus or minus 10 per cent of the allowable cut for that period. Each licensee is required to submit an annual report setting out the forest activities (e.g. regeneration surveys, growth studies, protection planning, road construction, etc.) that have been undertaken during the preceding year.

Areas under long-term lease or licence in the different provinces, as for example, the Tree Farm Licence in British Columbia, the industrial management units in Ontario, and the sawtimber and pulpwood licences in New Brunswick, are for the purpose of supporting established industries which have a considerable investment of money in plant and equipment. There are also in most provinces (see Table I) residual areas of unalienated Crown land (in some cases classed as forest reserves) which come under the direct management of forest services with the timber being sold by tender and required to be cut over a relatively short period of time. This unalienated land, which is usually organized on an area basis for management purposes (the areas being known variously as public working circles, Crown management units, forest reserves or timber licences), provides timber for the smaller units of industry and for the local woods operator. Usually all costs of management and protection are borne by government, the recovery of these being cared for in the upset price established for the timber.

By way of summary, it may be said that, while the diameter limit is still applicable in some provinces in a general way (perhaps as much to establish the principle of control as anything else), increasing use is being made of management plans prepared by or at the direction of the provincial government. However, as with any other control system, there is the danger that the management or working plans will be looked upon as ends in themselves: in fact their effectiveness will be determined by the adequacy of the information on which they are based and the skill with which they are implemented. The problem involved in their implementation is well stated in [9] as follows: "It must be realized that working plans designed to regulate forests which have been in utilization for many years, where many industries small and large have been established, cannot be put into effect over night. They must be introduced gradually with as little disturbance as possible to the industry as a whole. Yet at the same time they *must* be introduced, because without working plans, with their regulated budgets and records, the successful practice of permanent forestry is impossible."

Regeneration. Implicit in the term "sustained yield" is the assurance of establishing a new crop at some predetermined level of quality and quantity to replace the timber cut. Indeed, for the management (or production) unit as a whole, there would be little technical justification for continuing the allowable cut at the level of current growth unless the cut-over was to be restocked promptly in preparation for maintaining that level. Management plans usually provide for this in general prescriptions which may be varied according to the problem and the silvicultural requirements involved.

In some regions, as represented particularly by the Maritime Provinces and eastern Quebec, the regeneration of the forest appears to present no serious problem except after extensive fires when the advance growth and seed source may have been destroyed. It has indeed been pointed out with reference to Newfoundland for example [7], that "the most striking feature of the forests ... is their recuperative power. Despite the ravages of fire and long continued overcutting, released advance growth and reproduction are building up new volumes of commercial products vigorously and continuously." The question has been raised, however, for some parts of the Maritime Provinces, as to how adequate the natural regeneration will be in providing for quality wood in the future, having in mind that much of it is balsam fir which is often seriously infested by insect pests [5].

While little attention is given to the question of regeneration in the legislation of these provinces, most of them do maintain small nurseries to provide a limited amount of planting stock. In Quebec under the Lands and Forests Act, stumpage charges may be reduced where a licensee has undertaken "approved silvicultural works", so far this has been implemented by providing planting stock free of charge or by the payment of a planting bonus.

With a continental climate, as represented by Ontario, for example, the chances for satisfactory regeneration are more variable and, according to the Crown Timber Act of that province, the annual plan to be submitted to and approved by the Minister must include a statement of the measures to be undertaken by the operator "to promote and maintain the productivity of the area cut over." In addition, the Minister may require other measures to be undertaken by the licensee "as he considers advisable to promote and maintain the productivity of the areas cut over ...". While the Crown Timber Act implies that industry will be responsible for maintaining productivity on licensed lands, the trend at the present time is towards developing some degree of co-operation between government and industry in this undertaking. In the meantime, pilot-plant operations are being carried out on Crown management units to gain information both on methodology and the silvicultural requirements of some commercial species. Also, in some instances planting has been undertaken by industry to supplement natural regeneration where it is felt that this is the best means of assuring high-quality timber production in the future.

In British Columbia, on the Tree Farm Licence areas, the working plans make provision for prompt restocking by natural or artificial means. However,

93452—45½

on all short tenures, the Forest Service is responsible for regeneration, and to this end maintains a system of forest nurseries.

The major problems in this phase of management are first to establish the potential value of the site in terms of growth capacity and accessibility and then, if this is positive, to determine the need and degree of action to be taken, if any, to make full economic use of the growth capacity in the future.

Utilization. Sustained-yield management has little significance if the resulting products are used inefficiently. Legislation in most of the provinces is concerned with a number of different aspects of this problem, and in all cases includes sections aimed at reducing the volume of waste in forest operations, mainly by establishing maximum dimensions of material (for example, stump heights, top diameters, etc.) that may be left in the forest and providing special requirements or incentives for removing fire-killed or otherwise damaged timber. Penalties for noncompliance with waste regulations usually involve fines at a rate of so much per unit volume of material left.

In order to deal with other utilization problems, in some provinces legislation provides requirements or incentives aimed at (a) promoting the cutting of timber on licensed areas to a level approaching the allowable cut, (b) preventing lands being held for speculative purposes, and (c) directing that timber be cut to serve certain specified industries. In New Brunswick, for example, in order to encourage the operator to remove the maximum allowable cut and give full consideration to markets for all softwood species, a fixed charge has been made to each licensee of two cents per cunit[9] of softwood inventory with a corresponding reduction in stumpage, and in Ontario, for the purpose of increasing the domestic supply of sawtimber material in the province, the Minister may under the Crown Timber Act "determine the species and quantities of Crown timber that may be cut by any licensee for the manufacture of lumber, pulp, paper, or other products."

As noted elsewhere, in most provinces legislation favors at least primary manufacture of forest products in Canada, if not in the province in question. Such legislation may either require that primary manufacture be undertaken in this country, or simply give authority to prohibit export of raw material from the Crown lands of the province.

The Approaches to Forest Management Problems

While there are still tremendous areas of unoccupied Crown forest in this country, nevertheless the provision of high yields of quality timber on the more productive and accessible sites is most important to ensure that our wood-based industries will be in a competitive position, as costs tend to make forest operations in the more remote regions sub-marginal. The level or degree of management will tend to vary with the access and productivity of the area, and for this reason general prescriptions calling for the replacement of all timber harvested by "a forest as good as or better than the original" will be found too demanding for some areas and not demanding enough elsewhere. It would appear, therefore, that as sustained-yield management is being developed and applied, decisions on these matters must be made for each area or limit based on a careful evaluation of local conditions.

Sustained-yield management implies a succession of timber crops on the same area of land and hence a continuity of interest by those responsible; furthermore, it involves some expenditure of money, presumably by those who will, in the long run, reap the benefit. Difficulties may arise here in the administration of Crown lands, partly because industry, which is often held responsible for certain phases of management procedure, has no rights or equity in the future productiveness of the limit, and also because government in its responsibility to administer Crown land "in the public interest" may not be authorized to commit large areas of land in perpetuity for single-purpose use. There have been a number of approaches to this problem of Crown land administration, which are adaptations of, or definite departures from methods used solely for timber disposal.

(i) First, is the practice on public working circles, Crown management units, and other forms of uncommitted Crown land, of the government service being responsible for all protection and management undertakings and costs, these being included in the upset price at which the timber is to be sold. This method gives government full authority to develop and use the land and forest as required, but may be of disadvantage to established industry in not ensuring a long-term supply of wood at a stable price.[10]

(ii) In the other direction, there have been at least two proposals by investigating commissions, having as their aim the consolidation of supplies of raw material with industry to have the responsibility for and the benefit from long-term management; one of these proposals was made by the Royal Commission on Forestry in British Columbia (1945),[11] and the second by the Forest Development Commission in New Brunswick (1957).[12] The New Brunswick recommendation has not been implemented in its original sense or form, while in British Columbia, following recommendations of a second Royal Commission on Forestry (1955), further amendments of the Forest Act replaced the Forest Management Licence with the Tree Farm Licence, changed perpetual tenure to one on a 21-

year basis with renewal (to overcome the charge of monopoly), and placed responsibility for the details of management procedure increasingly with the Forest Service.

(iii) The third approach, which comes somewhere between the first and second, provides that under fairly wide legislative authority the Minister may enter into *agreement* with industry to share the responsibilities and benefits of management over a specified period of time and in relation to the problems particularly significant to the limit in question, or alternatively accept responsibility for management while guaranteeing wood supplies over a period of time and at certain levels of cost adadjustable to general economic trends.

Matching Costs with Benefits in Agreements

In the text of this paper, reference has been made in a number of cases to *agreements* being entered into between governments at different levels on the one hand and between industry and government on the other. This is a procedure which in its best form provides the means of sharing both the costs and the benefits associated with resource development between the parties concerned and in relation to their respective interests and responsibilities.

When under the B.N.A. Act the federal government placed the natural resources under the jurisdiction of provincial governments, it was with the object of providing those governments with a source of income that would help defray the costs of provincial administration generally. Since 1867, as a result of increasing costs of forest protection and management, the net income from Crown timber has in many cases decreased, while as a result of a corporation income tax, the income of the federal government, indirectly from the forest resource, has increased tremendously. Following recommendations of the Advisory Committee on Reconstruction (1943) [1], the federal government accepted responsibility, first under the Canada Forestry Act, and later the Department of Forestry Act, to assist provincial governments with various matters involved in the protection and management of the forest resource. As a result and by way of implementation, agreements have been entered into between certain of the provinces and the federal government whereby the federal government has provided financial assistance in the undertaking, particularly of forest protection programs, inventory surveys, and reforestation projects. It appears to be a fairly common view among provincial governments that while the principle is excellent, its implementation would bear extension.

Management plans are a form of agreement between industry and government when they apply to Crown lands under licence; these and other types of agreement at the same level as, for example, that provided for recently in the Fires Prevention Act of Ontario (and referred to earlier) are advantageous both in providing a vehicle for co-operation between the two parties and in taking into consideration local problems and conditions which may not be adequately dealt with through general legislation and regulation.

Evaluation of Current Situation in Light of Projected Needs

Present legislation with respect to Crown forests across Canada is a complex pattern, representing various stages in the transition from forest exploitation to forest management and one that is evolving under the influence of many different factors and conditions, some political, some social, and some economic. While in the beginning management procedures have been introduced through rules and regulations associated with the basic pattern of timber disposal, it is possible that this method will be increasingly inadequate as the basic interest moves from the disposal of the natural forest to ensuring the continuous productivity of forest land.

It seems highly probable that the bulk of the forest land in this country will remain in the title of the Crown[13], and therefore progress towards more efficient utilization of our resources will depend in the main on government policy as expressed in legislation and regulations, and the effectiveness of this will in turn depend on the knowledge and understanding of those in authority. To this end, it is important that all objectives, functions, and concepts associated with the use and management of Crown forests be rationalized and placed in their proper setting: that, for example, the purpose and implications of sustained-yield management be clearly understood and that its practice be associated more with economic incentive than government regulation; that Crown charges be established on the basis of function, e.g., as commodity costs, service charges, or taxes; and that the various demands upon, and potential uses of the forest be evaluated,[14] both in their over-all contribution to our well-being and in their compatibility one with the other.

Providing Adequate Staff

It is in dealing with these problems – the evaluation and rationalization of various factors and concepts – that the professional forester should play a vital part and one for which his training and experience should well qualify him. In the past the forester has undoubtedly had an important role, not only in developing and influencing trends and counter trends in the philosophy of conservation, but also in the solution of technical problems, the development of administrative procedures, and the implementation of legislation.

In four of the provinces there are legally constituted associations for the registration of professional foresters – Quebec, New Brunswick, British Columbia, and Ontario – and all but the last of these, it is required by law that each document related to the management of Crown forests, whether licensed or unalienated, be prepared and certified by a registered member of the provincial association. In general, the forester has been responsible for the study, planning, administration, and control of all phases of forestry work, and undoubtedly the extent and importance of these activities will increase with the increasing demands and pressures on the forests and forest lands of Canada.

Notes

[1] As there is no Crown land under provincial authority in Prince Edward Island, no reference is made to that province in the present paper.

[2] As suggested in the definition of Crown timber as including "any trees, timber, and products of the forest in respect whereof the Crown is enabled to demand and receive any royalty, revenue, or money."

[3] Crown lands and Crown forests may be administered as separate entities when, for example, the timber is cut and the land used for a purpose other than timber production, or they may be considered identical as when the land is managed for a continuous yield of forest products.

[4] Thus in New Brunswick at the present time all aspects of current legislation are under study to find ways and means of improving forest utilization and management practices following submission of the report of the Forest Development Commission [6].

[5] In Ontario, for example, between 1926 and 1947 there were a number of acts and amendments passed by the legislature (Forestry Act, 1926; Provincial Forests Act, 1929; Pulpwood Conservation Act, 1929, and amendment, 1936; Forest Resources Regulation Act, 1936; Forest Management Act, 1947; and Crown Timber Act amendment, 1947) which attempted to deal in one way or another with various aspects of forest management and administration, such as the consolidation of idustrial holdings, the planning for industrial expansion, the control of woods operation in detail, the subdivision of the Province for management purposes, and the allocation of responsibility for management programs. Eventually, following a recommendation of the Royal Commission (1947), all the essential points in these acts were brought together in the Crown Timber Act, 1952.

[6] The problem and its solution are well stated in the report of the British Columbia Royal Commission on Forestry (1945) as follows:
"Having reviewed our present position, the next step must be to define our broad, future objectives. At present our forest resources must be visualized as a slowly descending spiral. That picture must be changed to an ascending spiral. Differently phrased, we must change over from the present system of unmanaged and unregulated liquidation of our forested areas to a planned and regulated policy of forest management, leading eventually to a programme ensuring a sustained yield from all our productive land area."

[7] Under the Natural Resources Act of 1930, responsibility for the administration of the forest resources of Manitoba, Saskatchewan, and Alberta and the railway belt of British Columbia was transferred from federal to provincial jurisdiction.

[8] Following the transfer of resources to the western provinces in 1930 (Natural Resources Act) the Rocky Mountains Forest Reserve, which includes the sources of a number of important rivers, was established under *agreement* between the governments of Alberta and Canada as a multiple-use project for water conservation, pasture, timber production, and recreation.

[9] A cunit is 100 cubic feet (solid content).

[10] A further extension of this principle would be the establishment of forest operating companies as recommended in the Report of the Ontario Royal Commission on Forestry, 1947 [8] and as represented at the present time in Saskatchewan by Saskatchewan Forest Products, a Crown company appointed under the Forest Act as "an agent of the Minister for the purpose of harvesting, marketing, and utilizing the forest resources of the Province."

[11] Following the recommendations of the British Columbia Royal Commission (1945), the revision of the Forest Act in 1947 made provision under a Forest Management Licence for (1) consolidation of privately owned and Crown timber under one management authority and (2) personal management of the area by the licensee in perpetuity, provided general regulations were adhered to and Crown charges paid.

[12] It was recommended that the basic charge to industry be a rental on an area basis, graded according to productive capacity, and to be adjusted periodically in keeping with certain economic trends.

[13] In Nova Scotia, where originally much of the public land was granted or sold outright, there has been a reaction to that policy, and since 1934 nearly 600,000 acres of cut and burned-over lands, as well as lands bearing merchantable timber, have been purchased by government with the aim, in time, of establishing about one-third of the woodland of the province with the Crown.

[14] The means of doing this may be illustrated by reference to a co-ordinating committee on land use established by Order-in-Council in Saskatchewan in 1951. The purpose here was to establish better basic land-use practices in recently developed and developing agricultural areas in the forest regions, to bring under protection and management blocks of land which are not of agricultural value, but might in time become highly important for forest production, and to establish the importance of forestry principles in relation to the development of new agricultural areas.

References

[1] Canada. Advisory Committee on Reconstruction: II Conservation and Development of Natural Resources. (Final Report of the Sub-committee). The King's Printer. Ottawa. 1944. pp. 29.

[2] Canada. Dominion Bureau of Statistics. *Canadian Forestry Statistics: Revised 1959*. Queen's Printer. Ottawa. 1960. pp. 72.

[3] Canadian Institute of Forestry. A Brief Presented to the Royal Commission on Canada's Economic Prospects. Ottawa. 1956. pp. IV+ 41+8.

[4] Gibson, J. Miles, and L. R. Seheult. Report to the Royal Commission on Forestry in British Columbia, 1955, on the Management of Forest Lands in Eastern Canada. 1955. pp. 84+XV.

[5] Johnson, R. S. "Cutting Practices in Spruce Silvicultural Management in Eastern Canada". *For. Chron.* 36, 1960 (140-4).

[6] New Brunswick. Forest Development Commission. Report of the New Brunswick Forest Development Commission. Fredericton. 1957. pp XII+154+maps.

[7] Newfoundland. Royal Commission on Forestry. Report of the Royal Commission on Forestry, 1955. The Queen's Printer. 1955. pp. 240+maps.

[8] Ontario. Royal Commission on Forestry. Report of the Ontario Royal Commission on Forestry 1947. The King's Printer, Toronto pp. 196+maps.

[9] Stokes, J. *Forest Management Planning and Control in British Columbia*. 1959 pp. 14.

APPENDIX I

LEGISLATION

Alberta

1. The Forests Act. R.S.A. 1955 c.118 (with amendments to 1957). Edmonton. The Queen's Printer, Alberta. 1958. Pp. 79.

British Columbia

1. Forest Act (R.S.B.C. 1948, c.128; 1949, c.24; 1950, c.22; 1951, c.29; 1953 (2nd Sess.), c.9; 1954, c.11; 1955, c.27; 1956, c.20; 1957, c.23; 1958, c.17; 1959, c.34), and amendment 1960, c.96, Queen's Printer, British Columbia. 1959 and 1960. Pp 74 and 4.

Canada

1. Department of Forestry Act 8-9 Eliz. II, c.41, 1960. Queen's Printer, Ottawa. 1960. Pp. 5.

Manitoba

1. The Crown Lands Act. R.S.M. 1954, c.57. Winnipeg. The Queen's Printer, Manitoba. Pp. (21).
2. The Forest Act and Regulations. R.S.M. 1954, c.90. Winnipeg. The Queen's Printer, Manitoba. 1954. Pp. (29) +26+5.
3. The Fires Prevention Act. R.S.M. 1954. Winnipeg. The Queen's Printer, Manitoba. 1958. Pp. 17+1.
4. An Act Respecting Provincial Parks and Provincial Recreation Areas. R.S.M. 1960, c.53 (107). Winnipeg. The Queen's Printer, Manitoba. 1960. Pp. 8.

New Brunswick

1. Crown Lands Act. R.S.M.B. 1952, c.53 (and amendments for 1954, 1955, 1957, and 1959). Fredericton. The Queen's Printer, New Brunswick. Pp. 23.
2. Forest Service Act. R.S.M.B. 1952, c.93, and 1953, c.93 (12). Fredericton. The Queen's Printer, New Brunswick. Pp 2 and 1.
3. Forest Fires Act. R.S.M.B. 1952, c.91 (including 1953 amendments), and 1959, c.48. Fredericton. The Queen's Printer, New Brunswick. 1953 and 1959. Pp. 24 and 1.
4. Schedule of New Brunswick Timber Regulations in Effect, August 1, 1960, authorized by Order-in-Council. Department of Lands and Mines, Fredericton, N.B.

Newfoundland

1. The Crown Lands Act. R.S.Nfld. 1952, c.174 (and amendments: 1957, c.57; 1954, c.57; 1953, c.43). The Queen's Printer, Newfoundland. 1952, 1953, 1954 and 1957.
2. The Crown Lands (Cutting of Timber) Regulations. (Effective September 14, 1954). The Queen's Printer, Newfoundland. 1954. Pp. 14.
3. An Act Respecting Forest Fires. R.S.Nfld. 1952, c.179 (and amendments: 1960, c.47). The Queen's Printer, Newfoundland. 1952 and 1960. Pp. 9 and 4.
4. The Logging Camps Act. R.S.Nfld. 1960, c.21. The Queen's Printer, Newfoundland. 1960. Pp 22.
5. The Provincial Parks Act. R.S.Nfld. 1952. c.35. The Queen's Printer, Newfoundland. 1952. Pp. 4.

Nova Scotia

1. The Lands and Forests Act. R.S.N.S. 1960, c.145. Part I, Crown Lands, 1957, Pp. 27; Part II, Forests, 1957, Pp. 18; Part III, Game, 1960, Pp. 73. The Department of Lands and Forests, Nova Scotia.

Ontario

1. The Crown Timber Act. S.O. 1952, c.15 (with amendments: 1954, c.19; 1956, c.14; 1959, c.23; 1960, c.18); and regulations made thereunder. The Queen's Printer, Toronto. 1960. Pp. 40.
2. The Forestry Act. S.O. 1952, c.32 (with amendments: 1953, c.39; 1959, c.39; 1960, c.39); and regulations made thereunder. The Queen's Printer, Toronto. 1960. Pp. 8.
3. The Provincial Parks Act. R.S.O. 1958, c.83 (with amendments: 1959, c.78; 1960, c.88). The Queen's Printer, Toronto. 1960.
4. The Forest Fires Prevention Act. R.S.O. 1950, c.144 (with amendments: 1951, c.28; 1952, c.31; 1953, c.38; 1955, c.24; 1959, c.38). The Queen's Printer, Toronto. 1959.
5. The Public Lands Act. R.S.O. 1950, c.309 (with amendments: 1951, c.71; 1952, c.86; 1953, c.88; 1955, c.66; 1956, c.72; 1957, c.99; 1958, c.86; 1959, c.81; 1960, c.94). The Queen's Printer, Toronto. 1960.
6. The Wilderness Areas Act, 1959: S.O. 1959, c.107. The Queen's Printer, Toronto. 1959. Pp 2.

Quebec

1. Department of Lands and Forests Act. R.S.Q. 1925, c.43, s.1 (with amendments). Laws Respecting Public Land and Forests, etc. Department of Lands and Forests, Quebec. 1959. Pp. 1–5.
2. Lands and Forests Act R.S.Q. 1925, p. 44, s.1 (with amendments). Laws Respecting Public Land and Forests, etc. Department of Land and Forests, Quebec. 1959. Pp. 6–62.
3. An Act Respecting the Protection of our Forest Resources. R.S.Q. 1954, c.25. Laws Respecting Public Land and Forests, etc. Department of Lands and Forests, Quebec. 1954. Pp. 66–76.

Saskatchewan

1. The Forest Act. 1959. R.S.S. 1959, c.96 (with amendment: 1960, c.75). The Queen's Printer, Saskatchewan. 1959 and 1960. Pp. 36 and 4.
2. Forest Regulations under the Forest Act (1959). The Queen's Printer, Saskatchewan. 1960. Pp. 16.
3. The Prairie and Forest Fires Act, 1958. R.S.S. 1958, c.15. The Queen's Printer, Saskatchewan. 1958. Pp. 24.
4. The Provincial Parks and Protected Areas Act, 1960. The Queen's Printer, Saskatchewan. 1960.

Survey and Assessment of Forest Management Practices on Private Lands

R.S. Johnson,
Chief Forester, Bowaters Mersey Paper Company Limited, Liverpool, Nova Scotia.

and

L. Holt,
Assistant Forester, Bowaters Mersey Paper Company Limited, Liverpool, Nova Scotia.

The freehold woodlands in Canada are a small fraction of the total forest. But because of their location near concentrations of industries and population and their relative productivity, their contribution to the forest economy is far greater than their mere acreage suggests.

The individual holdings range from countless tiny farm woodlots to a limited number of corporate ownerships, some of which run to more than a thousand square miles.

Management of large holdings is often on a par with the management of Crown limits. In fact, in British Columbia, Crown and Private holdings are placed under combined management by those taking advantage of the tree farm legislation.

High-grading induced by restricted outlets, disorganized marketing, faulty taxation and ignorance have been the universal bane of management on smaller holdings. Nova Scotia and Ontario have introduced legislation intended to curb destructive cutting of timber, but because these regulations are based on unsound premises, they have achieved only limited success. British Columbia has tried to influence cutting practices by offering tax incentives for good management.

Mismanagement is lowering the productivity of much freehold forest. A nation-wide educational campaign, known as the Tree Farm Movement, aimed at checking this, has had only minor success except in one or two small regions.

The high cost of labor, lack of capital for equipment and forest improvements, shrinking markets for low-grade wood, the high rate of turnover among forest property owners, the unavailability of fire insurance at reasonable rates, and sometimes low royalties for Crown timber are other factors contributing in varying degree to the gradual deterioration of much of the forest land with the best potential.

The Crown lands of the country are capable of supplying the extra wood to compensate for the impoverishment of the woodlot insofar as volume is concerned. But they cannot match the economic status of these most fertile and accessible lands. Both the local and national welfare will suffer unless all kinds of legislation with a bearing on the management of private forests are made to harmonize with the basic prerequisites of sound forestry.

The Extent and Importance of Freehold Forest

Most of Canada's vast forest wealth is owned by the State (or in legal phraseology, the forests are invested in the Crown), and is administered by the provinces. Over 90 per cent of the forested area from coast to coast is *Crown land.*

This paper deals with the remaining 10 per cent. In that perspective, private forests seem to be an unimportant part of the national economy. Indeed, in terms of mere volume, the foreseeable demand for forest products could be met from Crown lands alone.

However, the supply of forest products responds to regional (or even local) demand, and there is a limit to the transportation costs which wood can incur and still remain competitive. Private forests are found chiefly in the accessible southern parts of the country and their average potential productivity is higher than that of Crown lands. Private forests are also important because they are owned by a great many people, most of whom obtain cash income from them.

It is assumed – because lack of space precludes proof – that freehold woodlands hold a position in our economy disproportionate to their extent.

Reliable forest inventories are expensive but indispensable for orderly forest management. So long as wood is superabundant, the cost of accurate inventories is seldom justified. This explains why provincial governments have only recently begun to classify accurately the forest resources within their boundaries.

Great impetus was given to forest inventories by the Canada Forestry Act (1949) under which the cost of such work was shared by the federal and provincial governments. Seven of the ten provinces(all except Newfoundland, Prince Edward Island and Quebec) now have fairly reliable figures on forest area, volume, species and age-class distribution.

The productive forest area of Canada in *private* ownership is outlined in Table 1. Some provinces do not separate Crown from private lands in their latest inventory reports, and thus some of the acreages shown may not be entirely accurate.

Table 1. Area of Productive Freehold Forest in Canada

Province	(in acres) Forest Area	Per Cent
British Columbia	(a) 6,595,084	10.8
Alberta	(b) 2,839,000	4.7
Saskatchewan	(a) 4,676,080	7.7
Manitoba	(a) 2,100,811	3.4
Ontario	(a) 10,363,232	17.0
Quebec	(b) 16,640,000	27.3
New Brunswick	(a) 8,191,000	13.4
Prince Edward Island	(c) 346,000	0.6
Nova Scotia	(b) 7,900,000	12.9
Newfoundland	(b) 1,320,000	2.2
Canada, Total	60,971,207	100.0

(a) Provincial Forest Inventory Reports

(b) Information from provincial governments

(c) Canadian Forestry Statistics, 1959. Dominion Bureau of Statistics, Ottawa.

The estimated merchantable volume of timber on private lands, in the provinces which have this information, is shown in Table 2. Of the seven provinces that have up-to-date inventories, only four sampled private lands separately.

Table 2. Merchantable Volume of Standing Timber on Freehold Property in Six Provinces

Province	(in millions of cubic feet)		
	Softwood	Hardwood	Total
British Columbia	16,395	1,005	17,400
Saskatchewan *	327	1,215	1,542
Manitoba	80	182	262
Ontario	5,426	10,199	15,625
New Brunswick	5,132	2,850	7,982
Nova Scotia *	3,850	1,148	4,998

* Estimates not based on separate sampling in inventories.

Statistics pertaining to private forest lands are extremely inadequate except those on total area. Some of the provinces, e.g. British Columbia, Ontario and New Brunswick, are better off than others in this regard. It does not necessarily follow that good statistical information means the area concerned is well managed, but it is generally true that where it is lacking, forest management is weak.

Perhaps as much as 40 per cent of the annual cut in Canada comes from private lands, although the statistics are very weak. As a cash crop from farms, wood is exceeded only by wheat, barley, tobacco, cattle, hogs, poultry and eggs. It is estimated that farm woodlots represent about 40 per cent of the total privately-owned forest lands in Canada.

For the period 1955–57, the annual farm cash income from the sale of wood products was $46 million, while that from maple products was an additional $7 million.[7] This includes only the reported sales, and total production values are higher. If the value of wood products cut and used by the owner is added, the annual values are greater still. The annual value of forest products cut from private lands in recent years is probably not less than $100 million. But, until we get accurate utilization records, all discussion and planning of management policies for private lands lack a factual base.

Present Management Practices

Population pressures will make multiple-use concepts imperative, but this paper can deal with forestry only

as a commercial enterprise. In any event, the pertinent legislation and the attitude of the public prevent private owners profiting from multiple-use in its broader sense, as will be discussed later. In this paper, therefore, forest management is defined as "the application of business methods and technical forestry principles to the operation of a forest property".

Protection

Protection of freehold forests against fire is now fairly good, but in dry years there are still heavy losses, such as those in British Columbia, Prince Edward Island and Nova Scotia in 1960.

In most provinces, forest-travel permits and permits for burning brush and logging debris are required during fire seasons or very dry times, with provision for cancellation of permits at critical periods. Legislation on slash disposal, fireguard spaces, and fire supression by owners and operators is too varied to discuss here, but it appears adequate within practical limits.

In five provinces, fire suppression on private lands is a duty of the provincial department responsible for lands and forests. In Newfoundland, a forest protective association assumes this responsibility, and the same is true for most of Quebec. Quebec freehold land not covered by association membership is protected by the Department of Lands and Forests which levies on the owner an annual charge of $12 to $14 per square mile.[23]

Apparently responsibility for protection against fire rests on the owner in Prince Edward Island, and on the municipalities in Alberta and New Brunswick. In New Brunswick 8 of the 15 counties have agreements whereby the Province provides protection at a fixed annual charge per acre of freehold land; in the other counties, it is reported that there is no organized or effective municipal fire protection on private lands. However, the Department of Lands and Mines fights fires wherever they occur. Counties not protected by contract are billed for costs.

Only three provinces levy direct forest fire taxes on private lands. These are:

British Columbia	6¢ an acre, on wild land exceeding 640 acres, on *Tree Farm* land and on timberland not included in a forest management license;
Ontario	2¢ an acre, only on lands originally granted to railways;
Nova Scotia	¾¢ an acre, on holdings of 200 acres or more.[23]

Many of the large landowners throughout Canada maintain fire-fighting equipment and suppression personnel far in excess of legal requirements.

Cutting Practices and Regeneration

The management of large privately owned forests has improved considerably since 1945. However, the lure of maximum immediate or early profit, coupled with heavy forest taxation in some provinces, still results in the transition of many thousands of acres of highly productive forest land into areas of inferior growth and low productivity.

Unrestricted private management tends towards high-grading, overcutting and devastation, generally sacrificing growing stock of commercial species by indiscriminate clear-cutting of all marketable material, even in young stands. Cutting methods used to encourage regeneration of desired species are exceptional, and satisfactory regeneration after logging is usually accidental.

The authors believe that depletion from cutting, fire, insects, disease and wind exceeds the annual growth on woodlots and other small privately-owned forest holdings in Canada. Of the larger holdings, some are being overcut, while others are being held in reserve; a large proportion of the latter are overmature and declining in volume and quality.

In British Columbia, the private forest holdings of the lower Coast forest are being liquidated,[21] although cutting there does provide for satisfactory regeneration if judged by minimum standards. The upper Coast forest is being undercut, but it is doubtful that the present total cut of the Coast region can be sustained. A gradual decline of Coast lumber production is anticipated despite an increasing demand, [5,21] under present conditions of utilization.

According to MacQueen:[21] "Accessible portions of the interior of British Columbia are being locally overcut, relative to the capacity of contiguous sustained yield units. A substantial volume of production amanates from 'uncontrolled areas' which are being rapidly liquidated".

Throughout British Columbia, cutting on large holdings generally provides for adequate regeneration of desired species, but small owners tend to clearcut regardless of the consequences. There are marked exceptions where tree farming is practiced under the Tree Farm Act.

Indiscriminate clearcutting for usable and marketable products is general on private lands throughout the Prairie Provinces with little or no regard for the

results, and regeneration of desirable species is generally poor.

Clearcutting for usable products is common in the privately-owned softwood forests of Ontario, Quebec and the Atlantic Provinces. In general, this results in more or less satisfactory regeneration when the cutting is in mature and overmature forests where advance growth is established. Clear-cutting of young stands, as practised on many small properties, usually results in inadequate softwood reproduction.

Regeneration is usually unsatisfactory in jack pine types regardless of cutting methods. The same is true of most of the upland forest types in the Clay Belt of Ontario and Quebec. Apparently the only proven method of reproducing satisfactory softwood forests in these types is by planting – a rare practice on private lands.

Clearcutting of mature and overmature spruce-fir forests in the Atlantic Provinces may generally leave enough advance growth to provide adequate softwood regeneration, but generally it is mostly to balsam fir. Because of its susceptibility to insect attack, balsam is increasingly considered an undesirable species. This is particularly true in Nova Scotia, southern New Brunswick and in southwestern and eastern Newfoundland where a chronic and spreading infestation of balsam woolly aphid is fast making balsam a weed species, except for use as Christmas trees.

In all regions, areas where fire has followed clearcutting are usually barren or occupied mainly by weed species for many years. Clearcut lands are the most susceptible to fire; the hazard is high on them for the first five to ten years because of slash, and for the next 20 years because of even-aged immature growth.

High-grading has long characterized cutting in the hardwood forests of the eastern provinces, and the declining demand for fuelwood accentuates this tendency except where there is a market for hardwood pulpwood. High-grading is resulting in forests which have been called sylvan junk. Grazing is common in farm woodlots, and this accelerates deterioration.

In the Maritime Provinces, the beech bark louse infestation, birch die-back, and bad cutting practices have ruined most tolerant hardwood forests except for hardwood pulpwood and fuelwood.

Cultural Practices

Tree Planting on Private Lands

The number of trees shipped from provincial nurseries is outlined in Table 3. However, not all these are trees planted on forest lands. (A survey conducted in Ontario in 1951 disclosed that about a third of the

Table 3. Number of Trees Planted on Crown and Private Lands in Canada in 1958

Province	On Private Lands	On Crown Lands	Total
British Columbia	(a) 6,618,200	1,632,500	8,250,700
Alberta	(b) xxx	xxx	(c) xxx
Saskatchewan	90,530	(d) 228,125	318,655
Manitoba	100,000	(e) 850,000	950,000
Ontario	17,096,505	(f) 16,080,698	33,177,203
Quebec	2,639,600	(g) 667,837	3,307,437
New Brunswick	xxx	xxx	(c) xxx
Nova Scotia	(g) 210,000	164,000	374,000
Prince Edward Island	(b) xxx	xxx	xxx
Newfoundland	(b) xxx	xxx	(c) xxx
TOTAL	26,754,835	19,623,160	46,377,995

xxx Negligible or nil.

(a) Some of these trees are probably planted on Crown lands by private organizations.

(b) No provincial forest nursery.

(c) A small number planted experimentally; a provincial transplant nursery, with seedlings from Federal Forestry Branch, has been established.

(d) Approximate figure.

(e) Includes municipalities, conservation authorities, etc.

(f) Does not include industrial organizations.

(g) Average for 1955-59 inclusive.

trees shipped from nurseries were never planted.) This wastage has been much reduced in Ontario, Manitoba, Quebec and British Columbia, but it is felt that there is still not enough control over the use of stock shipped from nurseries in other provinces.

The need and economic justification for planting can be logically analyzed only for specific areas and conditions. It is therefore unwise to comment on Table 3 in specific terms. One should note, however, that Ontario and British Columbia, with about 29 per cent of the total freehold forest land in Canada, account for 89 per cent of all trees planted on private land.

The information in Table 3 also suggests that, if the amount of planting in British Columbia and Ontario is now approaching the economically justifiable limit, then the extent of planting in the other provinces is inadequate.

However, even in British Columbia many authorities believe that planting is not keeping pace with the creation of areas classed as *not-satisfactorily-stocked* or *non-commercial-cover*, and no headway can therefore be made to reforest old cutovers. In spite of its good showing in Table 3, British Columbia is still increasing its areas of nonproducing land. Sloan[4] recommended an annual planting program of 38.4 million trees, or about four times the present number. Under the (B.C.) *Forest Act*, an owner must plant if the Province considers this necessary.[6] If he does not do so, the government may at the owner's expense. No land owner has been prosecuted under this legislation, but the B.C. Forest Service has persuaded some land owners to plant under the terms of the Act.

The Nova Scotia Section of the Canadian Institute of Forestry is prepared to recommend an expansion of nursery capacity in that Province to seven million trees by 1966 and to ten million by 1971.

In terms of costs at compound interest , there are not many acres in Canada where private enterprise can justify planting trees on bare land except for Christmas tree farming. But in areas already being managed for forest products, planting costs can be regarded as a reinvestment of funds to maintain the forest on a sustained yield should natural regeneration not suffice. Here it might appropriately be asked whether it is sound public economy to allow even private lands to lie indefinitely idle.

Other Cultural Practices

Silvicultural practices such as seeding, soil scarification, pre-commercial thinning, stand improvement, drainage, etc. are undertaken only rarely on private lands. Some larger owners do such work experimentally, but there is otherwise no evidence that cultural practices are as yet accepted working procedures of forest management on private lands.

Factors Affecting Management

The explanations commonly given for the low level of management on private forest holdings in Canada are many and varied. It should be stressed that the intensity of management is only relative to the owner's objective in owning a woodlot.[13] There is one large group of owners (those who inherited their properties) who may or may not have an objective. The continuing *flight from the farm* indicates that rural occupations, including woodlot management, are not attractive to those who were born to them.

There is another large and fast-growing group of owners who acquired forest property for many reasons other than to produce wood, among which are weekend and holiday camping, fishing and hunting.

In evaluating the level of management of private forests, one must disregard at present those properties whose owners have outside sources of income and objectives of ownership other than wood production. How much land may be so classified is impossible to state, but it is considerable, especially within 100 miles or so of large metropolitan areas.

Education

Ignorance of forest management usually results in poor practices, but it does not follow that more knowledge would necessarily ensure better management. Some of the means of disseminating information on forest management are discussed below.

Training in forest management is given at four universities and three forest-ranger schools in Canada. In-service training is provided in a few provinces and several agricultural schools have farm woodlot courses.

The Canadian Forestry Association spends the larger part of its budget on making the general public *conservation minded*. This Association is sponsored by private individuals, business organizations, and the federal and provincial governments, but industry and governments should give it more active support than they do. Since the Association was reorganized, the provincial governments' responsibilities will be to its provincial branches. The most active provincial association is that of Quebec; Ontario, British Columbia, and New Brunswick also have active Forestry Associations. The Prairie associations concentrate on general conservation education, but do little in woodlot management.

Forestry Extension

Most of the provinces, except Newfoundland and Prince Edward Island, sponsor extension work with private owners. In all provinces except Nova Scotia and (to a small extent) British Columbia, this is done on request.

In this sphere, Quebec is outstanding and Ontario is not far behind. The provincial forest service in Quebec maintains a separate extension branch with a full-time chief and 12 or 13 district extension foresters working under him. Extension forestry is a career in Quebec, whereas in other provinces men are temporarily assigned – usually part-time – to extension work, but are transferred to other duties almost before they have mastered their jobs.

Industry does some extension work, but its contribution is small. To the authors' knowledge, the only examples of sustained efforts by industry to assist the private owner is in the Hawkesbury district of the Ottawa Valley and in the Manitoulin Island area.

The Tree Farm Movement

To encourage better woodlot management, the Canadian Forestry Association and its autonomous provincial affiliates sponsor the establishment of *Tree Farms*. An owner can have his property certified as a Tree Farm, by pledging himself to four basic conditions which constitute minimum management requirements.

The aim of the Tree Farm Movement is to stimulate good woodlot management by example. The authors asked about 60 foresters throughout Canada for their opinions on the efficacy of the tree farm concept in raising standards of forest management on private lands. The replies were very discouraging. Six years after the Tree Farm Movement was launched, it seems that only two areas could report success. The first area is within trucking distance of Hawkesbury, mentioned previously. The Wood Procurement Division of the company concerned has consistently spent considerable sums to promote tree farms in its district. Its success is explained partly by expenditures of time, effort and money, and partly by the fact that the pulpmill buys wood of almost all the local species. The woodlot owner has a market for what he produces, not only from his harvest cuts but also from improvement cuts should he practice silviculture. Naturally, tree farming can only succeed through advice and example on a voluntary basis. Thus, even in the Hawkesbury district, perhaps only 10 to 20 per cent of the woodlot owners are good forest managers, but this is far above the national average.

Tree farming is also partly successful in New Brunswick. Although only about two per cent of the woodlot owners have responded, these are owners who manage their lands intensively and their example is spreading. The reason for New Brunswick's good start is that tree farming is largely implemented by two full-time foresters and two or three more in summer employment. These foresters have a definite procedure when approached by a woodlot owner. These men first provide air photos of the applicant's property with the boundaries and provisional forest types delineated thereon. Then they examine woodlots with the owners and provide inventories and management plans if desired. The owner, if he qualifies as a tree farmer, will have received valuable help and will feel fully justified in joining the movement.

Co-operatives and Woodlot Owners Association

In some cases, co-operatives furnish forestry advice to their members, but this is a rare exception and none of these organizations, to the writers' knowledge, employ foresters.

Very recently woodlot owners in eastern Nova Scotia and Cape Breton Island have formed an association, but as yet there is no indication that they plan any extension activities. A woodlot owners' association on the national level has been formed, with headquarters in Montreal, but it is too early to evaluate its activities.

There is yet no sign, therefore, that the woodlot owners intend to join forces to promote better management.

Legislation

In a democracy, it is virtually impossible to enforce good management of private forests by law. However, destruction of growing stock and the impairment of future productivity of the site can be prohibited. Except for fire laws and taxation, only three provinces have passed legislation applicable to private lands. [3], [4], [6], 28 and 29.

In British Columbia the legislations is permissive in that private and Crown land may be combined under the provisions of a Tree Farm License (formerly Forest Management License). Under this system, private lands are managed for maximum sustained-yield, subject to current economic conditions. The authors believe that this procedure is the most progressive yet adopted in Canada to encourage good forest management.

In Ontario, under the Trees Act, any municipality may pass by-laws approved by the Minister of Lands

and Forests, restricting the destruction of trees by cutting, burning or other means, and may appoint enforcement officers. The maximum penalty for infraction is a fine of $500.[29] In practice, the ten municipalities that have invoked this legislation have set stump-height diameter-limits ranging from 14 to 17 inches. These by-laws may have prevented some land from being stripped, but the main effect has been to condone high-grading. These municipalities are in the hardwood belt of southern Ontario where the choicest species do not mature and produce high-grade timber until they are at least 20 inches in diameter. Trees under this diameter probably would not be cut in any event, and only the best of the large trees are cut, the rest being left to occupy valuable growing space.[34]

The Small Tree Conservation Act of Nova Scotia prohibits the felling of hemlock, pine or spruce less than 10 inches in diameter at stump height (except for road making, etc.) in any logging operation involving more than 50,000 board feet. Upon receipt of an application containing all the pertinent facts, the Minister of Lands and Forests may permit the cutting of smaller trees if he considers this would be good forestry practice.[28] Trees cut contrary to law may be seized and the offender may be fined from $100 to $2,000 or jailed up to one year. Enforcement is by civil action in the Supreme Court of Nova Scotia or by prosecution under the (N.S.) Summary Convictions Act.

In practice, clearcutting has been permitted wherever provincial foresters considered wind-damage might follow diameter-limit cutting. In some cases, cutting to diameter limits of from six to nine inches has been permitted. As a rule, regeneration conditions have received scant consideration, and many areas clearcut under permit are very poorly stocked with commercial species.

The Act implemented in 1946, was fairly well enforced until Hurricane Edna did great damage to Nova Scotia's forests in 1954 – almost as much in undisturbed stands as in stands where there had been moderate partial cutting. However, following damage to forests cut to the law's prescription, many owners attributed the loss to the legal restrictions. Since then, the provincial foresters have been less inclined to enforce the law so strictly.

The Act aims at improved forest management, but diameter-limit regulation is not good forest legislation. The Act has had good educational value, but this is now about over.

One bad feature of the Act is that it exempts small operations where mostly small trees are being cut indiscriminately. From 1953 to 1957 inclusive, only 4.2 per cent of the total private land was examined under the Act and only 27 per cent of the Province's total forest production was harvested under its restrictions.[11]

Taxation

Forest taxation is not discussed at length here because it is the subject of another Conference paper. It is obvious that taxation can promote either sustained yield management or liquidation of forest values. Municipal and provincial taxes deter forest management in Nova Scotia, precluding sustained yield management and being actually confiscatory in some cases.

In British Columbia, taxes tend to preclude forestry operations except on *Tree Farm Lands*. The (B.C.) Taxation Act was amended in 1951 to encourage sustained production in private forests. Forest owners complying with requirements concerning protection, maintenance of growing stock, and balancing cut against ability to produce, receive a Tree Farm classification for taxation purposes. Tree farm land is assessed according to the sustained annual or periodic crop obtainable from the site, and the general tax rate is one per cent. In contrast, so-called wild land and timberland are assessed on the much higher value of the land and the standing trees, and incur tax rates of three per cent and one and one half per cent respectively.[3]

Annual taxes on a tree farm with a fair balance between young growth and mature stands correspond to a severance tax averaging about 15 per cent. On properties composed entirely of immature stands, the tax is much heavier. On average, tree farms of fairly normal age-class distribution are reported to be assessed at between a third and a half of the valuation of lands not so classified. This should be a strong incentive to practice forest management.

In Ontario, Prince Edward Island, and New Brunswick, forest taxation may occasionally be onerous, but it is not generally considered seriously detrimental to forest management. In Quebec, forest taxes are substantial only in densely populated rural districts, but even there they are not heavy.

In Saskatchewan and Manitoba, forest taxes are low and do not deter good management. In Alberta and Newfoundland there is no property tax on timberland or standing timber.

According to James: "Sustained yield is what public policy ought to be and what it usually aims for – except in the field of property taxes".[17] Property tax on forests is taxation of liquidation value, and is fundamentally wrong; it invites liquidation thereby reducing

the tax base. A yield tax plus a nominal tax per acre is the fairest kind of forest tax. Taxation of the capitalized value of productive capacity is also equitable.

Federal taxation of profits from cutting or stumpage sales as *income,* while exempting profits from sales of land plus standing timber as *capital gain,* often encourages liquidation of private forests.

Financing and Insurance

Modern business needs sufficient capital to operate efficiently. The large private owner can borrow at prevailing rates, and where he combines the businesses of forestry and wood-conversion, no insurmountable difficulties exist.

A sound capital and liquid position tends toward greater efficiency in forestry as in other businesses. In woodlot management, the owners with capital tend to manage their lands more intensively than those with little or none.

Owners of smaller woodlots, and often larger forest properties, usually find it harder to borrow. Even if loans are available, forest properties are rarely profitable enough to stand prevailing interest rates.

Low interest farm-credit is more easily available, and equipment purchased by farm woodlot owners usually qualifies as farm machinery for this purpose.

Protection against risk is another important need of modern business, and insurance against almost any eventuality can be had. Forest fire insurance is obtainable in Canada, but excessive premiums make it unattractive. The Canadian Underwriters' Association quotes a rate of 2.1 per cent (subject to 90 per cent co-insurance or a distribution clause). This is probably only a suggested figure, because a rate of 2.7 per cent of insured value has been quoted in the Montreal area. Premium rates and their basis both suggest that most people and organizations consider our forests as an inventory asset, to be liquidated as economics dictates.

Timber damaged by forest fire can usually be salvaged. Generally the most serious fire damage is the destruction of stands which have not reached merchantable size and seed-bearing age. Insurance premiums should therefore be higher on young growth than on mature timber.

High premiums are caused largely by a lack of demand from forest owners for insurance. If many owners desired protection and if their properties were widely scattered, the chance of all or a majority of these properties being burned would be very slight, and the premiums should be correspondingly less. In the humid climate of the Atlantic Provinces for instance, the risk of any one acre of productive forest being burned in a particular year is almost negligible. In Nova Scotia about 8,000 acres, or less than 0.1 per cent of the total productive forest area, is burned each year. At this level of risk insurance rates should be attractively low, if enough well-dispersed properties were covered. As things stand, only a few Christmas tree growers insure against fire; other owners prefer to carry the risk themselves.

Marketing

Unless the timber grown on a property can be sold there can rarely be management, but the opposite – that good markets create high levels of management – by no means follows.

The nature of tree growth, multiplicity of species, differences in site quality, etc. are such that, if only one kind of wood product can be sold, intensive management is seldom possible. Rather, such management is favoured by proximity to population centers and a variety of wood-using industries which provide a market for low-quality material as well as prime products.

Prices obtainable for forest products are to some extent related to the various types of markets, although markets reflect only the demand factor, whereas prices introduce the supply aspect also.

In most of Canada, the supply of wood products is governed largely by operations on Crown lands. The enormous volume of virgin and second-growth timber, grown at no cost except for taxes, exerts pressure on the prices for wood from private lands. Although the price of wood from freehold land is usually below the delivered cost of wood from Crown lands, the margin is partly artificial. The bargaining power of thousands of small scattered owners is extremely poor as they must accept the offered price or leave their timber unsold. Many Crown land operators have more than enough wood for present needs and can vary their cut (and hence their purchases) so as to influence market prices.

The situation just described indicates that, until now, Canada has been in a fortunate position and has ample room for forest industry expansion. This state of affairs, however, is maintained partly at the expense of low stumpage returns to the small owner. It is only from stumpage that the funds for intensified management can come. In private forestry, low stumpage values always entail low levels of management.

Generally the percentage of income from sales of *finished* forest products going into taxes, profits, and labor (now mostly unionized) is unduly high compared with that going to the primary producer, or allowed for

stumpage. This situation denotes a concept of forest liquidation without thought for the future.

In terms of volume of wood marketed each year, co-operative and other forms of joint marketing play a small part. The strongest co-operatives are found in Quebec, of which the maple sugar co-operative is the most powerful.

Other Factors

1. *Crown Land Regulations* – These can exert either a direct or an indirect influence on private land management. In British Columbia, those private lands that have been merged with Crown lands under tree farm licenses are subject to Crown regulations. The management of the combined holdings is thus directly affected.

Regulations applying only to Crown lands can also affect private lands, because the stricter the regulations the greater the costs they impose on the operator, and hence the higher the price he can pay for freehold wood.

2. *Relationship Between Rental Charges and Stumpage Charges on Crown Land* – Efficient operators are mainly interested in the average delivered price of their wood; this is made up of fixed and variable costs. In some instances, Crown stumpage rates are maintained or lowered while rentals are increased. This means that the larger the cut, the lower the government charge per unit of wood cut. New Brunswick is trying this approach in order to stimulate larger cuts on Crown lands. To the extent that this is achieved, the demand for freehold wood will lessen and its price will weaken.

3. *Logging Efficiency* – Most private forests are small and the owners lack capital for efficient machines and logging methods. Logging costs are therefore relatively high although this is often not apparent if the owner himself works on the operation. The same thing often holds true where owners, especially non-resident ones, sell stumpage to small operators whose efficiency is impaired by lack of capital. The higher the operating costs, the lower the stumpage returns to the owner.

Rising efficiency through mechanical logging is reducing costs, but in most cases considerable destruction of advance growth occurs, leaving the land inadequately stocked. Since mechanization will increase, future forest management will probably be based to an increasing extent on artificial regeneration.

4. *High Labor Costs* – Labor costs in Canada are high compared to machine costs – especially near metropolitan centers. High labor costs reduce stumpage returns, thus prejudicing management of private lands.

5. *Poor and Inadequate Growing Stock* – Past abuse of private lands has generally resulted in poor-quality trees and low volume per acre. In these conditions, profitable forest management is impossible until after a period of low returns and high costs. Few are willing and able to hold land during this period. This points up the importance of maintaining the growing stock of a forest property. It also shows why clearcutting, though often good silviculture, is not suited to most small forest properties.

6. *The Long-Term Nature of Forestry* – Trees are slow to mature or even to become saleable. This entails deferred returns on investment in improvements. In this age, deferred returns have little appeal.

Also, it was only a short time ago that the forest was the main obstacle to clearing land for agriculture. Much of the cleared land was not suitable for farming, and in any event the outlook on forests acquired by the rural population during this settlement period still lingers into the present. This has an adverse effect on promotion of farm woodlot management.

7. *Rapid Turnover of Forest Properties* – This item and the previous one are incompatible, but both militate against intensive management. In Ontario, the Department of Agriculture has determined that 21 years has been the average length of farm tenure during this century. This must also apply to farm woodlots, while the tenure of independent woodlots and other nonfarm forest properties would probably be shorter.

Future Management on Private Lands

At the recent World Forestry Congress in Seattle, Glesinger stated..."The world's forests are still being destroyed, wilfully or ignorantly".[15] After reviewing the situation with many foresters across the country, the authors conclude that this applies to the private forest lands in Canada.

Canadian forestry literature, including several Royal Commission reports, is full of references to poor management of private lands as a whole. Except for large industrial ownerships, which must protect heavy investment in plants, management on most private lands is no better today than thirty years ago. This is not entirely the fault of forest owners. We are all implicated through wanting maximum immediate benefits from the country's resources without regard for the future.

"TIME" magazine has reported: "Canada's key exports – oil, grain, pulp and paper, lumber and minerals – are being undersold in crowded world markets by competitors with lower wage levels".[2] This is true

of forest products, even without real effort to maintain forest productivity, and this cannot long endure. We must cease high-grade cutting with no thought for maintaining growing stock, and the far-too-frequent liquidation of private forest properties.

Quoting Glesinger again, "It cannot be overstressed that governments, legislators and administractors still fail to appreciate fully the importance of forest development and conservation with the result that investments are insufficient, forest services are under-staffed and politically weak, and private capital not attracted even where forest development would be profitable".[15]

The people of each province must decide whether the private forest lands will contribute to their prosperity as a valuable *Resource for Tomorrow* or whether they will deteriorate as time passes.

The solution is obvious, but apparently not very attractive. Education (both public and individual), research (fundamental and applied), and other voluntary aids are all increasingly needed. But all these will be too late and too little unless the basic structure is secure. This basic structure, of course, is legislation.

We must have taxation and other legislation, both federal and provincial, which encourages rather than hampers sound forest management. We must also have legislation which, while allowing the owner discretion in managing his property, will prevent practices harmful to the community. To the extent that this might otherwise inflict economic penalties on individuals, public funds should be used to support the policy.[18]

Legislation of this kind need not be complex or hard to enforce after the initial breaking-in period. The choice for Canadians is simply this: either continued impoverishment of private forest lands, with all this entails, or some restrictions on freedom of action over private forest properties, mitigated by public financial assistance.

The authors do not predict doom; they believe that Canada as a whole has the resources to increase its output of forest products with or without improved legislation. However, without private land legislation, increased production will come mainly from Crown limits, and Canada's future prosperity growth will largely bypass those communities where private forest holdings today contribute their share of wealth and work.

Acknowledgements

Many foresters throughout the country helped the authors, partly by replying to a questionnaire and partly by supplying information on conditions with which the authors were not familiar.

The nature of our assignment is so broad that detailed discussion of very local conditions could obviously not be attempted. For this same reason, the acknowledgements that follow are not specified by location.

The authors wish to express their appreciation to the foresters named below, without whose help the paper could not have been written. Also, although the authors accept blame for the inaccuracies and the too sweeping generalizations that inevitably have crept in, they nevertheless feel that the paper reflects the considered opinion of the forestry profession in Canada on matters related to management of our private lands. Those who have helped us are: F.S. McKinnon, J.H.G. Smith, L.A. deGrace, A. Kilde, E.S. Huestis, W.R. Parks, M.A. Opper, J.G. Somers, C.C. Thompson, W.K. Webster, T.D. Fortier, G.H. Bayly, E.F. Johnston, D.R. Wilson, E.K. Dreyer, J.H. Brodie, A.N. Leaman, J.D. Coats, D. Avery, L.A. Nix, P.J. Ward, J.F. Flowers, J.H. Godden, W.A.G. Thurston, K.W. Hearnden, W.E. Steele, J.M. Taylor, J.K. Reynolds, C.R. Mills, R. Delisle, J.H. Breton, W.D. Bennett, G.E. Cross, E. Porter, E. Martinsson, A.R.C. Jones, J. Bruce Kelly, E.L. Howie, L.S. Webb, H.W. Blenis, R.L. Bishop, L.S. Hawboldt, J.A. Brennan, D.E. Nickerson, J. Miles Gibson, A.L. Best, G.C. Cunningham, E.L. Hughes, E.S. Atkins, J.D.B. Harrison.

The authors also wish to acknowledge the many valuable suggestions from the foresters mentioned below who reviewed a draft of the paper: J.H.G. Smith, M.R. Wilson, J.G. Somers, G.H. Bayly, F.S. McKinnon and W.R. Parks.

Bibliography

[1] Andrews, G.W., *Taxation of Privately Owned Woodlands in Southern Ontario.* University of Toronto.

[2] Anonymous, 1960. Article in "Time" magazine, Can. Edition. July 1960.

[3] British Columbia. Department of Finance, Surveyor of Taxes Office. *Tree Farm Land.* Victoria. 1952.

[4] British Columbia. Royal Commission on Forestry, 1955. *Report of the Commissioner Gordon McG Sloan relating to the Forest Resources of British Columbia, 1956.* Queen's Printer. Victoria. 1957. 2 Volumes.

[5] British Columbia. Department of Lands and Forest Surveys and Inventory Division. *Continuous Forest Inventory of British Columbia, Initial Phase 1957.* Victoria. 1958. 148 + (44) pp.

[6] British Columbia. Statutes of British Columbia. *Forest Act.* Victoria. 1959.

[7] Canada. Dominion Bureau of Statistics. *Canada Year Book, 1959.* Ottawa. 1959.

[8] Canada. Dominion Bureau of Statistics. *Canadian Forestry Statistics, 1959.* Ottawa. 1960. pp. 24.

[9] Canada. The Senate of Canada. *Proceedings of the Special Committee of the Senate on Land Use in Canada.* The Queen's Printer. Ottawa. 1959

[10] Canadian Institute of Forestry. *Brief to the Royal Commission on Canada's Economic Prospects.* Ottawa. 1956.

[11] Canadian Institute of Forestry. Nova Scotia Section, *Fifth Annual Report.* Truro. 1959.

[12] Candy, R.H. *Reproduction on Cutover and Burned-over Land in Canada.* Department of Resources and Development, Forestry Branch. Silvicultural Research Note No. 92. Ottawa. 1951 pp. 224

[13] Delisle, Roch., 1959. *La forêt Privee — Une Pourvoyeuse de Bois à Pâte.* Department of Lands and Forests, Extension Bureau. Quebec. 1959.

[14] Gibson, J. Miles. *Spruce-Balsam Management in the Provinces of New Brunswick and Nova Scotia.* Paper presented to New England Section, Society of American Foresters, at Boston (Massachusetts), U.S.A. 1959.

[15] Giesinger, Egon. "The Role of Forestry in World Economic Development". *Pulp and Paper Magazine of Canada.* September 1960. pp. 18—24.

[16] Hawboldt, L.S. and R.M. Bulmer *The Forest Resources of Nova Scotia.* Department of Lands and Forests. Halifax. 1958.

[17] James, L.M. *Property and Yield Taxes on Forests.* Department of Forestry, Michigan State University. 1958.

[18] Johnson, R.S. "Planning for Managed Privately owned Commercial Forests", *Forestry Chronicle* 32 (2): 138—146. 1946.

[19] Johnson, R.S. "The Forest Tax Situation in Nova Scotia and a proposed Remedy", *Forestry Tenures and Taxes in Canada, pp* 153—174. Canadian Tax Foundation. 1957.

[20] Love, D.V. "The Forestry Situation in Canada", *Forestry Chronicle* 35 (3):187—191. 1959.

[21] MacQueen, I.C. "Pacific Northern Railway Strikes Deep into Virgin Forests". *Canada Lumberman.* November 1960. pp. 52—53.

[22] Manitoba. Department of Mines and Natural Resources. *Forest Resources Inventory.* Winnipeg. 1959.

[23] Moore, A.M. *Forestry Tenures and Taxes in Canada.* Canadian Tax Foundation, Tax Paper No. 11. Toronto. July 1957. pp v + 315

[24] New Brunswick. Report of Royal Commission. *Rates and Taxes Act.* Fredericton. 1951.

[25] New Brunswick. Forest Development Commission. *Report of the New Brunswick Forest Development Commission.* Fredericton. June 1957. pp. xii + 154.

[26] New Brunswick. Department of Lands and Mines. *Forest Inventory.* Fredericton. 1958.

[27] Newfoundland. *Report of the Newfoundland Royal Commission on Forestry,* 1955. St. John's. 1955. pp. 240.

[28] Nova Scotia. Department of Lands and Forests. *The Small Tree Conservation Act.* Halifax. 1952.

[29] Ontario. *Statutes of Ontario, Trees Conservation Act,* Chap 399. 1950

[30] Ontario. Department of Lands and Forests. *Forest Resources Inventory.* Toronto. 1953. 1953—59.

[31] Quebec. *Quebec Agricultural Marketing Act,* Quebec Agricultural Marketing Board. Montreal. 1956.

[32] Quebec. Department of Lands and Forests. *Laws Respecting Public Lands and Forests.* Quebec.

[33] Saskatchewan. Department of Natural Resources, Forestry Branch. *Saskatchewan's Forest Inventory, 1947—1956.* Regina. 1959.

[34] Sinclair, Robert T. *"Then There Were None", in Timber of Canada.* December 1960.

[35] Wilkes, G.C. *Taxation of the Forest Industries in Ontario.* University of Toronto Press. Toronto. 1954.

[36] Wilton, W.C. *Forest Resources of the Avalon Peninsula, Newfoundland.* Department of Northern Affairs and National Resources, Forestry Branch. Tech. Note No. 50. Ottawa. 1956.

Taxation and Tenures as they Affect Forest Management

A.M. Moore
Associate Professor,
Department of Economics,
University of British Columbia,
Vancouver, British Columbia.

A fundamental problem to policy-makers is whether taxes on private lands and the charges and regulations which bear on Crown timberlands impede realization of the goal of maximum productivity of the forests over time. Several of these are of more than regional significance, and merit scrutiny for an assessment of their effect on the management of our forest resources. Six are considered in detail.

The property tax on private timberlands is a form of charge which often has the effect of rendering unprofitable silvicultural expenditures which would raise yields. Heavy taxes have quite often made it unprofitable for private parties to retain ownership of cut-over lands and title has been allowed to revert to the Crown.

The effect of a capital gains *tax exemption is exemplified when an owner of a tree farm sells his tree farm as a unit so as to realize a tax-free capital gain, in preference to selling cutting rights or timber from it – from which the profits are taxable income. This tax anomaly often induces the owner of timber property to abandon his plans for uninterrupted, maximum production over long periods of time.*

Most provinces impose various regulations designed to induce maximum use, for example specifying maximum heights for stumps left on a logging operation on licensed Crown lands. Regulations of this type often impose an unnecessary cost on operators without serving any apparent purpose.

On various occasions, some form of ground rent has been recommended as preferable to the present royalties system under which Crown timber is sold to licensees for specified charges per fbm (feet, board measure) or cord of timber cut. Ground rent, based on the licensed forest's natural productive capacity, would force a licensee to reconsider whether it was profitable for him to retain his claim to lands he was not operating. A rental system could also be used to provide an incentive to raise yields. There would be other consequences. Prices paid by mills for wood purchased from private timberland owners would be lower, and there would be a reduction in the amount of marginal timber left behind because it is not worth royalty charges.

As a condition of tenure, licensees to Crown lands are often required to meet specified minimum regeneration standards, and on occasion to undertake reforestation. Any judgment as to adequacy of the regulation raises the question of what level of silvicultural expenditures ought to be undertaken. This problem can be resolved only by using a comprehensive investment-decision procedure which takes account of all costs and benefits to the community.

In management planning within provincial forestry departments, while adequate attention is paid to the preservation of the existing productive capacity of forests, inadequate concern is shown for reduction of costs and encouragement of investments which increase productivity. To help remedy this, it seems desirable for the Crown to design its management planning, its charges and its regulations with the objective of having each mill seek out the least expensive wood, with each forest sending its output to the highest value-use. Forward planning, based on forecasts of timber production for decades ahead, would provide the framework within which provincial forestry departments could formulate their programs for approving annual and longer-term working plans, for the awarding of new licenses, and for encouraging the exchange of limits of licensees where exchanges would reduce wood costs.

Do taxes on private lands or the charges which bear on Crown timberlands deter or promote the maximum productivity of forests over time? This is the fundamental problem facing policy-makers and a problem widely discussed.

The economic effects of taxes and tenure arrangements are subtle, hidden from view, often potential rather than immediate, and are the result of policies based on technical and administrative—not economic—reasoning. Yet the economic aspects require just as much attention as the technical ones—and possibly more.

Since the war, discussions and investigations concerning the effects on forest management of taxes and conditions attached to the use of Crown timberlands have ranged around *eight* matters of more than regional significance. Six of these matters will be discussed here, namely: the effects of— 1) property taxes, 2) tax-free capital gains from the sale of woodlands, 3) certain types of provincial regulations, 4) the royalties system, 5) the determination of investment required to raise yields, and 6) the need for provincial forest management planning. The additional two matters of general interest are: 7) the logging profits taxes in Ontario and British Columbia, and 8) the income tax treatment of the forest-based industries as compared with the treatment of other natural resource industries.

Logging taxes are not discussed here since the debate about the taxes seems to have reached an impasse with the spokesmen for the two provinces being disinclined to defend the taxes and pleading financial necessity for their retention. It is unfortunate that these provinces do not seem to be searching for a better, alternative way of raising the needed revenue. The treatment of the forest industries under the provisions of the federal income tax are not examined because discussions to date have not produced any clear-cut set of agreed or opposing views. It has not been determined whether the forest industries are less favorably treated than other industries in general. In addition, the question as to whether or not forestry ought to receive some tax inducement comparable with that enjoyed by some of the other natural resource industries has only recently been raised.

The Prevailing Situation

The Crown in the right of the provinces owns about two-thirds of Canada's productive forest lands and the volume of wood production on Crown lands is also about three-fifths of the total. The federal and provincial governments own nearly all the inaccessible and unproductive lands as well. The private lands, however, have a much greater importance than indicated by these proportions since they contain the most valuable timber and the best sites, and it is on private lands that the prospects of increasing yields are the most attractive.

In most provinces Crown timber is sold for specified sums per thousand fbm or cord of timber cut, stacked and measured. These royalties vary according to species, and range from $1.00 per cord of jack pine pulpwood in Quebec to over $3.00 per cord of spruce and balsam fir in New Brunswick. The royalties are flat amounts and are changed periodically by Order-in-Council. They are not the estimated value of the timber on the stump. The exception to this system is found in British Columbia. There, in sharp contrast to elsewhere in Canada, the timber is quite valuable on the stump and Crown timber is either sold at auction or at prices set by *stumpage appraisal*, i.e. an estimate of the market value of the wood on the stump.

In all provinces, large and small areas of the public forests are licensed to companies for various periods. The licensees pay ground rents of $1.00 in Ontario to $10.00 per square mile in Quebec and larger amounts in British Columbia. In New Brunswick, the charge equivalent to ground rent is based on timber inventory rather than on area. The licensees also bear fire protection costs ranging from $15. to $30. or more per square mile. Licensees must comply with various Crown regulations and submit annual and longer-term cutting plans for approval. They must obtain approval for what and where they may cut and the maximum amount of cutting. Where there are minimum cutting rates, they are rarely burdensome.

About two-fifths% of the private timbered lands, by area, are farmers' woodlots which average 97 acres in size and contain fairly poor quality timber. There are also medium to large private holdings of poor to very valuable timber in most forested regions of the country. The main expense of private timberlands—and usually the only large expense—is the real property tax levied annually either by the province or the rural municipalities. This tax is usually a percentage of the estimated value of the standing timber.

Effect of Property Taxes

The property taxes falling on much of the private timberlands in Canada are very heavy. This is not because of high rates of taxation. Indeed, with few exceptions there is no distinction in rates for forest properties as distinguished from other properties.

The problem stems from the method of evaluating forest properties.

All capital employed to grow timber on private lands is in the form of taxable real property—the standing trees and improvements such as roads. Most of the capital eventually becomes the commodity sold by the industry and it is taxed each year during the life of the trees. A very low tax per year is therefore the equivalent of a high severance tax; that is, the cumulated value of the tax payments amount to a high percentage of the value of the trees when they are cut. The central difficulty is that the usual form of the property tax is inherently defective when applied against business properties; the tax weight varies greatly among industries whether measured in relation to profits, total sales or total capital employed.

The taxes are particularly heavy in Nova Scotia and New Brunswick and quite heavy in British Columbia and parts of Quebec and Ontario. In Nova Scotia the severance tax equivalent of the property tax exceeds 90 per cent in some instances. Even the tax on the special category of private property *Tree Farm Land* created in British Columbia to shield tree farming from unduly heavy taxation is the equivalent of a severance tax of 20 per cent and more.

The most destructive effects of heavy property taxes occur when much of the tree cover is removed in an area within a few years. This is likely to happen when the weight varies from county to county, as in Nova Scotia and New Brunswick. When heavy taxation is fairly uniform over a large area such as a province, there is less likelihood of bunching of the cut in one area.

The main effects of the tax then are:

(a) to cause most owners to cut their timber earlier than they otherwise would;

(b) to reduce the value of timber properties; and

(c) to render unprofitable the silvicultural expenditures which could pay their way with an average weight of taxation.

In addition, a heavy tax has often made it unprofitable for private parties to retain ownership of cut-over lands and title has been allowed to revert to the Crown.

If either the encouragement of an increase in yields of timberlands above natural growth or the creation of conditions favorable to investment in the forest industries is considered desirable, a heavy property tax must be reckoned as a major impediment.[1] The yield of wood, per acre, from private forest property is much greater than the yield from Crown lands and it is on these best sites that expenditures to raise productivity can be most profitably made.

Effects of Capital Gains on the Management of Woodlots

The realization of tax-free capital gains is apparently an irresistible lure to many owners of large woodlots and plantations to sell their properties outright. The psychological appeal may even be greater than justified by a dollar and cents calculation.

The difficulty is embedded in our British concept of capital gain. If a person operates a tree farm, selling cutting rights or timber from it, the profits are taxable income. If a person sells the tree farm as a unit—land and trees—he realizes a tax-free gain.

This matter is of little interest to the large corporation and of small moment to the farmer who has only a few acres of woodlot and pays little or no income tax. It is, however, of great importance to the owner of 50 or more acres of timber particularly if the trees are even-aged, as they usually are. Maximum profit accrues to an outright sale of the entire property and by the time the logging company which purchased it has finished its operation, the original owner's plans for uninterrupted maximum timber production are often seriously disrupted. So is his enthusiasm. Sometimes the original owner buys his woodlot back after it has been cut over, but this is an ineffective safeguard against the tax interference with the creation of a valuable timber property of increasing productivity.

Effect of Regulations Intended to Reduce Logging Waste

Most provinces have regulations designed to induce the maximum wood production from a stand of Crown timber being logged. There are the rules that stump heights may not exceed a certain number of inches, that sound logs may not be left behind and that certain sawlog-size timber must be used for lumber and and not for pulp.[2]

Surely these rules are of doubtful value. If it adds 15 cents to costs to lower the stump height of a particular tree by three inches and the extra wood obtained is worth five cents at the mill, the marginal three inches of log should be left behind. If it costs more to get a sawlog to the sawmill than the log is worth to the mill, what good is served in requiring the woods operator to make a loss?

It may be that the thought behind these regulations is that the supervisor of woods operations needs a goal to efficiency because he neglects costs and timber values in his concern to meet his wood pro-

duction quotas. If woods supervisors are really wasteful in a dollars and cents sense, a more effective remedy must surely be found.

Alternatively it may be that the motive behind these regulations is the protection of Crown revenues; the objective is to make sure that the licensee pays for all the timber in a stand which the forest service thinks is merchantable. If this is the intention, one way to go about it is to use a rental charge. Another way is to measure the timber before it is cut and charge accordingly, leaving it to the operator to determine which timber will and which will not be worth the cost of cutting and transportation. In Saskatchewan the timber on a leased concession is measured before logging operations and the charges are calculated according to this measure. However, the provincial government reserves the right to stipulate what must be taken and what may be left.

One can understand the reason for requiring that timber of less than a specified diameter be left to grow. Then, the forest service bears the extra logging cost since the logger presumably will not lease the concession unless he can recoup all his expenses. One can also understand a requirement that inferior species be cut to aid the regeneration of superior species. But the reason for requiring removal of timber not worth its transportation remains a puzzle.

The Royalties System

At present, Crown timber is sold to licensees for specified charges per fbm or cord of timber cut. Many observers are of the view that this system is an impediment to the objective of maximum productivity of the forests.

For a long time some form of ground rent has been recommended by various groups as the best type of charge to be made for the right to *tree-farm* a forest area. To some of these advocates the attraction of ground rent is that they force the licensee to decide whether it is worth the rental to retain his claim to timberlands he is not using, whether to keep all his limits and increase production, or whether to relinquish part of his holdings and make them available to others to use. In addition, if the licensee faced a rental which was stable in terms of timber yields and varied only with the value of the natural productivity of his lands, he would have the maximum incentive to increase their productivity. These are probably the most important advantages of a ground rent over a royalties system.

There would be other consequences of a switch to a rental scheme. To examine these, we shall assume that the Crown's revenue remains the same per cubic foot of wood cut.[3] It is also assumed that the licensee contracts to make a lump sum payment per year for his license, so that the Crown charge is a fixed cost so far as his wood procurement plans are concerned. When deciding how much wood to cut from his Crown limits and how much to purchase from farmers and others, the woods manager would then compare the cost of purchased wood with the logging cost of the marginal cut of timber on his Crown limits – not logging cost plus royalty, as at present. He would therefore reduce his bid for private wood. One would then expect the price of purchased wood to decrease, and there might be a temporary reduction in the cut of private and some increase in the cut of Crown wood.

However, prices bid by mills for private timber might not decline as much as this line of reasoning implies. When two mills are bidding for the same farmer's wood, and the transport costs are lower to one mill than they are to the other, the former mill may not have to offer a price equal to the cost of its own *limit* wood in order to win the bid. Consequently the amount by which prices offered for farm timber would decrease, would depend on how extensive or universal was the change to a rental scheme.

Nevertheless, some reduction in prices paid for private timber would result from a change to a rental system. That is, private timber prices would be lower in comparison to prices which would prevail under the royalties system – not permanently lower in an absolute sense. To put the matter another way, in comparison with a rental system, the royalties cause a type of subsidy to be paid by mills to woodlot owners. On the other hand, the imperfect market situation frequently prevents the woodlot owner from obtaining the full site value of his wood. The two existing imperfections cancel each other out to some extent.

Another effect of a change to a ground rent scheme is perhaps the most familiar one. There must always be some stands of Crown timber which lie on the margin of profitable extraction. Whether a licensee cuts them or by-passes them depends on whether the value of the logs at the mill is equal to the cost of procuring them. Since royalties are about 10 per cent of the cost of the delivered logs, on average, they must cause quite a bit of timber to be left behind, despite the contrary effect of cutting regulations. This effect of royalties is not as great as one might at first expect, if we are correct in the deduction that the removal of royalties would result in a level of log

prices permanently lower than would otherwise prevail. If log values fell by the full amount of royalties, for example, the balance of profitability between logging a marginal stand and leaving it behind would not be affected at all by the removal of the royalties.

How Much to Invest to Raise Yields?

Mention has been made of the regulations on stump heights and like matters. Other regulations which are not universally approved relate to satisfactory regeneration and reforestation. That we should have satisfactory regeneration may be taken to be beyond challenge. There is also general agreement that, in forestry, the failure to make a small expenditure now, in some circumstances, results in a loss some decades hence which is out of all proportion to the expenditure; and the loss to the community may be greater than that of the particular licensee of a Crown forest. Low regeneration expenditures often pay a high rate of return to the community.

It is in defining *satisfactory* regeneration and *desirable* reforestation that difficulties arise. In most private enterprise industries prospective profit is accepted as the appropriate test for deciding if an investment should be made. The only qualification is that when there are large social benefits or costs which do not enter the private company's calculations, an adjustment ought to be made. The only criterion for allocating priorities among alternative investments is the excess of benefit over cost.

This consideration is pertinent to the controversies which have gone on in Canada during the past decade about the level of expenditures which should be incurred to maintain or raise the productivity of our forests. Licensees are required to meet specified minimum conditions concerning regeneration and, on occasion, reforestation. This minimum program is considered inadequate by some observers. The imposition of minimum acceptable performance standards also suffers the defect of begging the fundamental question of the determination of the amount and the nature of the expenditures which ought to be made.

The same objection can be made to the decision of a provincial government that a licensee must bear the costs of growing a crop and must later buy the same crop. Such a policy might be the result of a deliberate decision to raise the charges placed on licensees. But again two separate issues are mixed, and one wonders whether they have been resolved by the use of appropriate criteria. When deciding the appropriate level of charges the Crown cannot avoid affecting the volume of investment in the industry. When deciding on the appropriate amount to be invested to maintain or raise the forests' productivity, the Crown cannot avoid using some implicit rate of return.

Even on the best sites, only very modest expenditures made at the beginning of a rotation of 50 years or more promise a return equal to the rate of interest, unless it is assumed that the stumpage value of the crop will be two or three times today's price in dollars of constant value. This is the reason why many people consider that a zero rate of return should be employed and propose that this be accomplished by charging regeneration and reforestation expenses off as costs of harvesting the existing crop. This is a haphazard solution. How much regeneration expense should be incurred as a cost of harvesting? Ten, 20 or 200 per cent of the value of the present crop?

It is possible to project the world demand for forest products, to make a judgment as to the limits of the areas from which Canadian companies can draw their future timber supply and remain competitive, and to conclude that, in some regions, if yields are not increased, the Canadian forest industry must either stop growing in the near future or face a timber shortage later on. And, of course, the idea of a shortage makes no sense unless we mean supply of timber at a specified cost.

Assuming that one accepts projections of the kind described, different conclusions can be drawn. One is that Canada's capital can be more profitably invested in other industries if expenditures to increase the timber supply cannot pay a rate of return greater than zero. If Canada's sawmills and pulpmills cannot maintain their projected rate of expansion unless they are subsidized in the form of a raw material supply at less than full cost, some of the projected investment should go into other industries.

Substantial objections are made to this negative conclusion. First, expenditures to raise yields suffer from the impediments of divided jurisdiction. Whenever both the government and private companies are involved – as in hydroelectric power development, for example–there is usually a push and pull by each side concerning the proportions of the cost each should bear, and the initiative of each to get on with the job is blunted. This holds true for the Crown forests. Second, there is the dubious consideration that Canada's overseas competitors apparently do not stick to the test of a rate of return greater than zero. Third, at the extreme, if the forest industries actually decline in a region there will be the social costs of transfer to another industry or region even if the

over-all rate of growth of the Canadian economy is not affected.

Finally, and most important, the amounts likely to be spent on raising yields are very small in relation to the magnitude of the effects some decades later. On this ground it is said that we should give the balance of doubt to more expenditures so as to err on the side of least harm. It is this consideration which lends greatest support to those who advocate investment in raising yields beyond the scale called for by the ordinary calculations of the return on an investment.

The reasoning runs as follows:

(a) there is low probability that the Canadian forest industries will be globally competitive some decades hence, on a scale exceeding the capacity of the foreseeable timber supply to provide it with raw materials at a competitive cost, unless yields are raised on the best sites, i.e. there is some probability that today's investments to raise yields will be profitable;

(b) this probability must be given a very low weight by private enterprise; in addition, the licensee may be deterred from investing in Crown lands, because of lack of full ownership;

(c) the consequences of an under-investment in timber growth is greater for the community than for the corporation which can seek out various international locations. If the increase in yields proves to be the decisive consideration for location in Canada of a proportionately larger amount of primary and secondary industry, this favorable outcome will have a high value to the community;

(d) the high value to the community of the favorable outcome offsets its low probability.

In short, the ordinary commercial investment calculation gives too small a weight to some very favorable outcomes which have a low probability.

If the decision of New Zealand and Chile to establish plantations of exotic softwoods required a retrospective justification, it could probably be most readily formulated along these lines. In addition to regeneration, reforestation and other standard measures to raise yields, a great increase in the appropriation of funds for the development of hybrid species of desirable properties and fast growth could also be defended by a similar line of argument.

If such a decision is explicitly and deliberately made, the size of the expenditure would still have to be decided. This amount should be calculated by estimating the value of the favorable outcome and attaching an estimated probability to it. In fact, there is no other rational way to decide about incurring any expenditure at all.

Provincial Forest Management Planning

The defect of present management planning by the forestry departments of the provinces is that the concern to preserve the productive capacity of the forests is given priority over the reduction of costs and the encouragement of investments which increase the forests' productivity.

Ideally, the sources from which each mill draws its timber should be such that the total laid-down cost of wood of the industry as a whole is minimum. In addition, the woods managers should have sufficient information to enable them to plan ahead for several decades to minimize their costs. These forward calculations should include a comparison of future costs of wood drawn from distant sites with cost of wood drawn from increased yield on the best and most accessible sites. In short, the woods manager should know how much wood he will be procuring decades from now, where he expects to get it, and what he expects its cost to be.

Most mills prefer to control more than half their timber sources. So, some arrangement is needed to serve the objective of the least total cost of timber to the entire industry.

Even where much of the timberlands is private property, there seems to be a puzzling reluctance on the part of companies to sell or exchange holdings when the exchange would benefit both parties. When the limits are Crown-owned and charges are made against profits resulting from the sale or exchange, surely the full rationalization of holdings is less likely to occur.

The rationalization of limit holdings also needs to be encouraged because a licensee is not required to pay the interest cost of the reservation of a limit for his use. Royalties are not paid until the timber is cut. If a company had full ownership of five times as much mature timber as it planned to use over the next few decades it would be unprofitable for it to hold the excess idle for that period of time. If, in the same circumstances, the timber is under license from the Crown the holding of the reserve is said to be attractive to the licensee. If the Crown royalties are $3.00 a cord and the company can obtain $3.50 from subcontracting the cutting rights, for example, it is said that the licensee might still prefer to forego the present profit and pay the ground rent to maintain its claim to the timber which it may want to purchase some time in the future. Presumably, the explanation of this alleged behavior is that the licensee fears

that if he engages actively in selling cutting rights his application for other Crown lands will be jeopardized and the forest service may even wish to reduce his holdings; or else the managers of the large companies may overlook the profits obtainable from woodlands operations because these operations are small in relation to manufacturing profits. It is also claimed that Crown regulations and fees impede the sub-contracting of cutting rights. To the extent that this behavior exists it increases total wood costs to the industry as a whole.

It can be persuasively argued, as some foresters do, that efficiency in the use of our timberlands would increase if every integrated company set up a subsidiary to carry out all its woods operations. The subsidiary would be ordered to make the greatest profits possible by selling to the highest bidder and the manufacturing company would be told to buy from the cheapest supplier. The Crown, it is suggested, should design its planning, its charges, and its regulations to serve the same objective of each mill seeking out the least expensive wood and each forest sending its output to the highest value use.

It seems sensible, therefore, that the comprehensive plan for the management of the province's forests should begin with a forecast of wood production for several decades ahead. Rather than the detail of cutting plans, the major concern of the Crown should be the production plans and forecasts of all licensees. Those which operate pulp and sawmills could be asked to file their forecasts of end-product production for some decades ahead, in terms of an average per year for five-year periods. Corresponding to their projections of their lumber, paper and board production, there would be estimates of timber requirements and of sources of supply. The sources should be detailed according to purchases from others or cut on the company's limits. If the latter, the particular licensed or privately-owned area could be designated. If the wood is to be purchased, the area and the type of vendor, e.g. farmers' woodlots, could be specified.

Similarly, all the large licensees to Crown timber who sell their logs to others could make projections of their operations, stating which areas they hoped to cut and to whom they hoped to sell their logs.

Independently of these projections of future operations made by licensees, the forest service of the province would have its own projections of timber production and supply, including sales to and purchases from other provinces and countries.

It is understood this sort of forward planning must be tentative and subject to constant revision. Nevertheless, once all the separate projections were put together and adjusted to be made consistent with one another, the forest service would at least have a framework within which to formulate its program for approving annual and longer-term working plans, for the awarding of new licenses, and for facilitating the exchange of limits among licensees where this would reduce wood costs. It would also enable the forest service to decide whether investment by a particular licensee was likely to be deterred by the lack of an assured timber supply.

For the licensee's part, an over-all forward plan would lend some assurance that the amount of timber which different companies expected to draw from a particular area – farmers' woodlots, for example – would not add up to two or three times the probable future supply. This type of forward planning by the Crown would increase the accuracy of companies' forward calculations. By increasing the information available it would help them to avoid miscalculations.

There would be little need for forward planning by a provincial forest service if the three activities of growing timber for the sale of cutting rights, the logging of timber and the use of logs to produce finished and semi-finished products were performed entirely by different parties. The need for planning by a central agency would be further reduced if there were large numbers of companies performing each activity and if there were highly organized markets for cutting rights, for logs and for timber properties. Our forest-based industry is not atomized, however, and it is not suggested that it should be. Since organized markets for timber properties, cutting rights and logs do not exist, some arrangement is needed to perform their functions.

Notes

[1] Where owners attempt calculations of profit. In instances of outright inefficiency as with overmature stands, in which the volume of sound timber is decreasing and held uncut for no apparent reason, the imposition of a heavy property tax to cause owners to make their lands productive is advocated by some foresters.

[2] No reference is intended to regulations designed to ensure satisfactory regeneration or reduce fire hazards.

[3] This is not intended to imply that the present level of charges best serves the interests of the community. The best level of charges is a difficult matter to decide, because the Crown possesses varying degrees of monopoly power in different regions. In general, the economist recommends that the price charged by a company with monopoly power should be the price which would emerge in a competitive market, so that the maximum value use is made of the resource. In the case of the forests, the calculation of prices which would perform the functions of competitive prices is extremely difficult. And, of course, competitive prices are not themselves universally and ideally efficient. If first priority were to be given by the Crown to what the economist calls an *optimum allocation of resources*, probably the best approach which the Crown could follow would be to calculate today's upset prices or royalties by discounting the prices expected to prevail in the future.

Bibliography

1. Anonymous. *Taxation and Conservation of Privately Owned Timber.* Proceedings of a Conference held at the University of Oregon, January 1959. Corvallis, Oregon.

2. Boulding, K.E. *Economic Analysis,* Chapter 36. Revised Edition. Harper and Brothers. New York. 1948.

3. Briggs, C.W. *Tax Treatment of Timber Cutting under Section 117 (k), Internal Revenue Code.* Forest Industries Committee on Timber Valuation and Taxation. Washington.

4. British Columbia. Royal Commission on Forestry, 1955. *Report of the Commissioner Gordon McG. Sloan relating to the Forest Resources of British Columbia, 1956.* Queen's Printer. Victoria. 1957. 2 volumes.

5. Butterick, P.L. *Forest Economics and Finance.* John Wiley and Sons. New York, 1948.

6. Canadian Institute of Forestry. *Brief to the Royal Commission on Canada's Economic Prospects. 1956.*

7. Ciriacy-Wantrup. *Resource Conservation Economics and Policies.* University of California Press. 1952.

8. Fairchild, F.R. et al. *Forest Taxation in the United States.* United States Department of Agriculture, Miscellaneous Publication No. 218. Washington. 1935.

9. Hall, R.C. *Appraisal of Special Forest Tax Legislation in Practice.* Proceedings of the 34th Conference, National Tax Association. 1941.

10. Hall, R.C. *The Forest-tax Problem and its Solution, Summarized.* United States Department of Agriculture, Circular No. 358. 1935.

11. Lutz, F.A. and V. Lutz. *Theory of Investment of the Firm,* Chapter 2. Princeton, 1951.

12. Marquis, R. "Severance Taxes on Forest Products and their Relation to Forestry," *Land Economics,* Volume XXV, August 1944.

13. Moore, A.M. *Forestry Tenures and Taxes in Canada.* Canadian Tax Foundation, Tax Paper No. 11. Toronto. July 1957.

14. New Brunswick. *Report of the New Brunswick Forest Development Commission.* Fredericton. June 1957.

15. Newfoundland. *Report of the Newfoundland Royal Commission on Forestry, 1955.* St. John's. 1955.

16. Scott, A.D. Natural Resources: *The Economics of Conservation.* University of Toronto Press. Toronto. 1955.

17. Wilkes, G.C. *Taxation of the Forest Industries in Ontario.* University of Toronto Press. Toronto. 1954.

18. Zivnuska, J.A. "Some Aspects of the Economic Theory of Forestry", *in Land Economics,* Volume XXV. May 1944.

Survey of Forest and Forest Products Research Organization and Activities

J.D.B. Harrison,
Deputy Minister,
and
D.W. MacLean,
Research Officer, Forestry,
Forest Research Branch,
Canada Department of
Forestry, Ottawa.

In foreign trade, Canada ranks fourth among the nations of the world and forest products outweigh any other group of commodities as a source of foreign exchange. Large increases in world demand for forest products are predicted for the next 25 years. Canada has an opportunity to benefit from this increasing demand if she is equal to the challenge. The forest industries are highly competitive and competition in world markets is increasing. To maintain their markets, Canadian industries must keep costs down and continue to improve the quality of their products. Results from forest and forest products research are fundamental to the achievement of these ends.

The need for more research is recognized by governments and by industry and the public is slowly becoming conscious of the role which research must play in improving forest management and utilization. Nevertheless, there is a shortage of adequately trained personnel in Canada. This may in part be due to some lack of appreciation of the satisfactions which careers in forest and forest products research can offer, but it also reflects the present inadequacy of facilities for postgraduate training and research at the university forest schools. These conditions may be attributable in part to uncertainties regarding opportunities for employment in research, which will be alleviated as governmental and industrial research programs develop.

During the 15 years which have elapsed since the end of the Second World War, forest research and forest products research in Canada have made great strides. Research staffs have been strengthened and a number of new laboratories and other research facilities have become available. But increases in world markets for products of the forest and the need for faster progress in forest management are combining to create increasingly urgent needs for more new knowledge. The Canadian situation is further complicated by the immense size of the forest and the accompanying variety of environmental conditions which govern forest growth and behavior. Our future prosperity depends, to no small degree, on the strengthening of present efforts to solve the manifold problems of forest management and utilization.

In some countries it is customary to use the single term *forest research* with reference to all aspects of research relating to forests and forest products. In Canada, forest research usually means studies, experiments or investigations directed toward securing new knowledge for purposes of forest management, excepting purely descriptive information such as is obtained by forest inventory surveys. Forest products research comprises studies concerned with the utilization of wood. This paper deals with both phases of research and the established Canadian distinction between the two fields is recognized.

Any appraisal of forest and forest products research must be made in the light of certain characteristics of the Canadian forestry situation. Some of these are dealt with at length in other papers but they are of such importance to research that they must be referred to here.

Forests occupy 48 per cent of the total land area of Canada and 68 per cent of the area of the ten provinces. A total of 715,000 square miles, or 41 per cent of the area classified as forest, is accessible and capable of producing recurrent crops of timber if given reasonably good management. Major differences in climate and physiography result in great diversity and the forests have been divided on a geographical basis into eight distinct and separate forest regions. (1,2). Each region is characterized by the presence of certain tree species and associations of species presenting their own problems in forest management and forest utilization. The tree species native to Canada number more than 150 and about 40 are of considerable commercial importance. These species are indigenous to this continent only and several, including the black spruce, the backbone of the Canadian pulp and paper industry east of the Rocky Mountains, are largely limited to Canada. The characteristics of the Canadian forests and a distinctive social and economic situation combine to restrict the direct applicability in Canada of solutions to problems discovered elsewhere. Nevertheless, research progress in other countries is kept under constant review and provides many valuable leads.

The high standard of living which Canadians enjoy is in a large measure the result of their forest heritage. For example, production of pulp and paper is the largest manufacturing industry. In 1957, all forest industries taken together, including operations in the woods, had a net value of production of $2,197 million or 12 per cent of the net value of production of all Canadian industries. The sale of products of the forest and forest industries on export markets in 1958 resulted in a credit balance to Canada of $1,180 million which may be compared with a deficit of $1,444 million arising from international trade in all other commodities. From these facts it is not difficult to visualize what the economic plight of the nation would be in the absence of forest industry.

The report of the Royal Commission on Canada's Economic Prospects suggests that the gross value of Canada's primary forest industry will more than double in the next quarter century. The Commission cautions that fulfillment of this promise rests upon certain contingencies. There is no certainty that the volume of wood to permit this industrial expansion will be available at a cost to make it competitive with other materials and with the products of other nations. The Commission states that the hope for the future lies in obtaining a much greater knowledge of the nation's resources including silvicultural characteristics of tree species and the ecological relationships of the communities in which these species grow, and in major advances in fire, insect and disease control. It is evident from this alone that the future economic welfare of Canada will in no small measure be influenced by achievements of forest and forest products research.

More than 90 per cent of the forests of Canada are owned by the Crown. With the exception of National Parks, Indian and military reserves and federal forest experiment stations, publicly owned forests within the provinces are administered by provincial governments in accordance with the British North America Act. Cutting rights on much of the best forest land are held by private industry under licence, lease or other arrangement. This system of administration and management places a joint responsibility on provincial owners and industrial occupants for the wise use of the major part of the forest resources. The system also results in forest and forest products research being directed mainly toward providing information which can be put to use by the provinces or private industry.

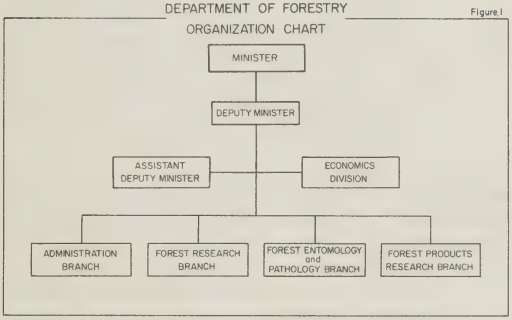
Organization of Research

Some observers have described the Canadian form of government as *co-operative federalism* and the spirit of co-operation is perhaps no better exemplified than in forest and forest products research. Research in these fields is undertaken by the federal government, provincial governments, private industry and universities. Much of it is carried out through co-operative efforts of two or more organizations. In any event, care is taken to ensure that the most pressing problems are given top priority and that the research of one organization supplements rather than duplicates the work of others. Various means are employed to ensure that efforts are carefully expended. Programs are developed through consultation between federal, provincial and private authorities. In some instances this is achieved through advisory committees and in others by means of informal conferences. Annual reports on active projects are prepared by federal and provincial governments and circulated to all interested authorities. The Woodlands Research Department of the Pulp and Paper Research Institute of Canada maintains an up-to-date directory of woodlands research by private industry and by the universities. Axioms of research planning provide further safeguards against duplication. When projects are proposed, the investigator must show a definite need for the solution to the problem he wishes to investigate and he must convince his organization that the problem is not being solved by others in his field.

Federal research organization.

Forest and forest products research by the federal government was undertaken until recently by the Department of Agriculture and the Department of Northern Affairs and National Resources. In 1960, these activities were brought together in the Department of Forestry created under the authority of the Department of Forestry Act.

Three of the four Branches of the Department are concerned with research. They are the Forest Research Branch, the Forest Entomology and Pathology Branch and the Forest Products Research Branch. Additional research is undertaken by the Forest Economics Division which is directly responsible to the Deputy Minister. The Administration Branch is responsible for the non-research functions of the Department. The organizational structure of the Department is shown in Figure 1.



The research programs of the Department of Forestry are intended to support improvement of the management and protection of the forest resources of Canada, better utilization of the products of the forests, and improvement of the competitive position of Canadian forest industries.

Research in forest management and related sciences is undertaken by the Forest Research Branch. Staffs concerned with forest fire and forest inventory research are maintained at Branch headquarters in Ottawa. Most research is undertaken through seven district offices and the Petawawa Forest Experiment Station, all directly responsible to the Director of the Branch and at four experiment stations administered by district offices.

The ultimate objective of the Forest Entomology and Pathology Branch is the reduction or prevention of timber losses caused by insects and diseases. Toward this end, the Branch carries out integrated programs of forest insect and disease research and surveys. In addition, the Branch provides advice and assistance to agencies responsible for direct control projects and other applications of the results of research in entomology and pathology. These functions are performed through 11 laboratories distributed across Canada. Programs are co-ordinated on a national scale by Branch headquarters in Ottawa.

The Forest Products Research Branch has laboratories in Ottawa and Vancouver. Both laboratories are staffed and equipped to work in the principal fields of research pertinent to wood and its uses including certain aspects of the wood chemistry field not relating to the manufacture of pulp and paper. The research programs of the two laboratories are integrated by Branch headquarters in Ottawa. The Branch also maintains field extension service with officers located in important industrial regions.

The Forest Economics Division carries out research in problems concerning the development of Canada's forests, studies the economic implications of forestry legislation, maintains records of Canadian forest resources, and analyzes statistics relating to the forest and its uses.

Close relationships with the provinces, the wood-using industries, and the university forest schools aid in ensuring a balance between the research programs of the Department of Forestry and national and local research requirements. A number of advisory committees are maintained and the Department is represented on the Associate Committee on Forest Fire Protection of the National Research Council, and committees set up by the Research Foundations of Ontario and Nova Scotia to advise on research problems in forestry and forest products. In Ontario, two joint federal-provincial committees review programs and arrange for co-operation in general forest research and in research in forest entomology and pathology. Each of the two forest products laboratories benefits from the advice of committees representing the forest industries.

Provincial research organization

Separate forest research organizations are maintained by British Columbia, Ontario and Saskatchewan. Some of the other provinces undertake a limited amount of research but they rely chiefly on the federal government to provide for research needs.

Forest research by the Province of British Columbia had its beginning in 1915 but remained on a very small scale for some years. In 1925, the first forest

experiment station was established and a second station was founded in 1929. By 1930, eight foresters were permanently employed on research. Then, from 1931 to 1948, research activities were restricted as they were in many other organizations throughout the nation. In 1948, an expanded program was undertaken and a decentralization of staff was carried out by establishing research centers in association with forest district headquarters. In 1960, the staff of the Forest Research Division was made up of sixteen professional foresters and six technical assistants. The divisional program is concerned mainly with research in silviculture, genetics and ecology.

The Ontario Department of Lands and Forests began forest research on a limited scale in 1930 and a separate research division was organized in 1941. Its policy is to assess research needs of the Department, secure co-operation with existing agencies, and develop departmental research services. The Research Branch as currently constituted is organized into eight sections, namely: forestry, wildlife, fisheries, forest soils, tree breeding, physics, statistics and mechanics. The Branch undertakes a broad program of resource research, almost half of it in fields other than forestry. A research station is maintained and research foresters are attached to regional administrative offices. In 1960, the staff engaged in forest research consisted of 30 professionals and a supporting staff of 20.

The Department of Natural Resources of Saskatchewan created a small forest research division in 1957. In 1959, the Division had three professional and three non-professional workers engaged in cull and volume studies in co-operation with the federal government, and in silvicultural research.

The Province of Quebec does not maintain a separate forest research division but some research is undertaken by the Bureau of Silviculture and Botany and by the Bureau of Meteorology. Some of the other provinces undertake small-scale studies in forest research; for instance, the Nova Scotia Research Foundation has a program in forest ecology and genetics in co-operation with three of the five universities in the province. Additional work by the provinces, in fields related to forestry, provides useful basic information to the forest research worker. A program concerned with the genesis of soils being carried out by the Research Council of Alberta is one illustration.

Provincial governments have not been nearly as active in forest products research. The Province of Quebec maintains a forest products laboratory which operates on a part-time basis and certain provincial research councils undertake a limited amount of work in this field.

Research at Universities

The forestry schools at the universities of British Columbia, Toronto, Laval and New Brunswick each undertake some research. It is to a large degree a concomitant of postgraduate instruction and is chiefly concerned with ecology, botany and tree physiology. Twenty-eight members of forestry faculties do research amounting to about 11 man-years annually. Work by supporting staffs and graduate students amounts to 15 man-years. Expenditures, exclusive of professors' salaries, are estimated to be $120,000 annually, some of which accrues from research grants by the National Research Council, provincial governments, and private corporations. Extramural research grants by the Canada Department of Agriculture, amounting to about $10,000 annually, have aided specialized research in forestry problems by biology and chemistry departments of a number of universities. In passing, it is emphasized that the limited amount of research funds available to forestry faculties is a real handicap to the development of programs of graduate training adequate for Canadian needs.

Research by private industry

Forest research and forest products research are undertaken by a large number of individual corporations and by the Pulp and Paper Research Institute of Canada.

The Pulp and Paper Research Institute represents a mode of development sometimes forgotten in this day and age. It is not unusual to think of governments taking over activities from private enterprise but the fact that private enterprise may undertake activities initiated by government is not as widely recognized. The Institute is an excellent illustration of changing responsibilities of the latter type. It had its beginning in 1913 as a Branch of the Forest Products Laboratories of Canada. Then, in 1920, the Canadian Pulp and Paper Association joined its pulp and paper research activities with those of McGill University and the federal government. In 1950, the Institute acquired its present form as a non-profit, tax-free, educational and research corporation under federal charter with a board of directors and full-time professional management. Two directors are designated by the Crown, six by the Canadian Pulp and Paper Association and three by McGill University. The federal government discontinued financial support in 1956, but provided a new laboratory for the Institute's use at Pte. Claire, P.Q. The

growth of the Institute from 1913 to the present reflects long and continued co-operation between government, industry and the University.

The Institute undertakes a broad program of basic research in the field of pulp and paper and in the reduction of waste. It also maintains a Woodlands Research Department which undertakes research in silviculture, ecology, tree nutrition and logging. In 1960, the Department had a professional staff of eight and a supporting staff of five. The total staff of the Institute in 1960 consisted of 150 individuals, including 50 professionals. In addition, 25 graduate students spent most of their time on research at the Institute. The 1960 budget was about $1.5 million of which $250,000 were allocated to the Woodlands Research Department.

Forest research by individual corporations had its beginning many years ago. The earliest undertaking seems to have been background investigations for the well-known planting program of the former Laurentide Company Limited, which began in 1913 near Grand'Mere, Quebec. However, with few exceptions, research by individual companies remained on a limited scale until after the Second World War. In the past ten years, there has been a rapid increase in company activities, and programs now embrace a wide range of endeavor, although they are concerned mostly with silviculture. There are considerable differences between companies in the interpretation of the meaning of forest research and some tend to classify as research various forest management operations such as reproduction surveys. Nevertheless, the composite program is impressive and it holds great promise for the future. In all, 40 individual companies or subsidiaries of companies undertake at least some forest research and a number of companies have substantial programs. It is particularly encouraging that 128 members of professional staffs spent a combined total of 30 man-years on forest research in 1959, at an estimated direct cost of about $420,000. Forest research grants by companies to various institutions, other than the Pulp and Paper Research Institute of Canada, account for an additional expenditure estimated at $140,000.

The contribution of private companies to forest products research is also of major importance. Most of the Canadian pulp and paper companies have laboratories, in which they conduct industrial research relating to their products. In addition, the industry undertakes research in the development of equipment and improved methods of logging adapted to particular operating conditions.

Research in Canada, the United Kingdom and the United States—A Comparison.

In any field of resource management the practices of tomorrow are only as good as the foundations which are laid by research of today. The need for forest and forest products research is clear; the amount of effort which should be directed toward fulfilling this need is more difficult to decide. Such a decision cannot be based on facts alone. It also requires value judgments.

The importance of forest and forest products research to national welfare is clearly recognized in many countries including the United Kingdom and the United States. Some indication of the relative efforts expended in those countries and in Canada is evident from a comparison of numbers of professional research workers for 1960 (Table 1).

Table 1. Professional Workers in Forest and Forest Products Research Employed by National Governments in 1960.

Field	Canada	United Kingdom	United States
Entomology, pathology and related sciences	160		164
Management and related sciences	96		698
Total forest research	256	51	862
Forest products research	67	90	127[a]

[a] Includes civil servants only. About an equal number of individuals are employed on a contract basis.

Note: In Table 1, values for the United Kingdom and the United States are derived from *World Forest Inventory 1958*, F.A.O., Rome, 1960. The values for the three countries are not entirely comparable but they are close approximations of relative magnitudes.

It is emphasized that the values in Table 1 are limited to personnel employed by national governments. This limitation arises from the virtual impossibility of obtaining recent information on research workers in all the various state, university and private research organizations in the United States. It is also necessary to keep in mind certain differences in research organization in the three countries. In Canada and the United States, a substantial amount of forest research is undertaken by provincial and state governments; in the United Kingdom no such division of research among different levels of government exists.

In comparing research activities, consideration must also be given to differences in forest resources. Some of these are evident from Table 2.

Table 2. Some Resources Statistics for Canada, the United Kingdom and the United States

Country	Forested areas[3]			Wood removed in 1959[4]
	Productive	Non Productive	Total	
	— million acres —			— mil. cu. ft. —
Canada	611	482	1,093	3,040
United Kingdom	4	—	4	110
United States	528	252	780	11,280

Note: Values for the United Kingdom and the United States are derived from the yearbook of Forest Products Statistics, 1960, F.A.O., Rome.

Some dissimilarities in emphasis given to forest and forest products research are outstanding. From them, it is evident that Canada is not keeping pace with others in laying foundations for forest management and utilization practices of the future. It is significant that the wood removed in Canada exceeds by more than 25 times the amount removed in the United Kingdom, yet numbers of workers in forest products research are much smaller here. The United States with a smaller productive forest area extracts more than three times as much wood as Canada. This to a large degree reflects better accessibility, a climate more generally favorable to tree growth and a much larger domestic market, but it seems also to be influenced by a greater application of research results. Some solace may be taken from the fact that numbers of professional workers in entomology and pathology employed by the Government of Canada compare favorably with those in the United States Forest Service. This situation furnishes little comfort when it is realized that in forest management and related sciences, federal research efforts in the United States in 1960 were seven times as great as comparable efforts in Canada. When research by the federal governments of Canada and the United States is considered in the light of numbers of square miles of productive forest, differences in emphasis given to management and related sciences are revealed even more clearly. In Canada, there is only one professional research worker employed, by the federal government, for every 10,000 square miles, whereas in the United States there is one for every 1,200 square miles. Realization that this country was falling behind in research in forest products and management and related sciences led the Government of Canada to consider a policy of substantially increasing research in forest management over a five-year period beginning in 1959.

Research Activities

Forest and forest products research embraces many fields of the applied, natural and physical sciences and it requires contributions from many disciplines. In the following paragraphs several broad spheres of endeavor are discussed to shed some light on the progress which has been and is being achieved and to suggest some of the more pressing problems which require attention. In general, distinctions are not made between forest research activities of federal, provincial and private authorities. In a statement of this kind, such distinctions are often impossible because many forest research projects are undertaken co-operatively by several agencies. The roles of government and private industry in forest products research are described separately because of a much more clearly defined division between fields of endeavor.

At this stage, it is well to point out that recent technological advances, especially the invention of modern computing machines, have greatly increased the productivity of research workers. Computing machines are particularly well suited to the compilation of many types of data collected in forest and forest products research. They are not, however, an unmixed blessing and continued studies are required of codes, forms, mathematical functions and processing methods to ensure that the most effective use is made of this modern equipment.

Forest products.

In Canada, forest products research is carried out by two principal organizations. The Forest Products Laboratories of Canada undertake research in forest products on a nationwide basis, research in paper pulps and paper manufacture excepted. The Pulp and Paper Research Institute of Canada, the second principal organization, leads research in the latter field. Individual pulp and paper companies undertake a substantial volume of industrial research, and a limited amount of research in forest products is carried out by universities and provincial research councils.

Research activities of the forest products laboratories of Canada.

The activities of the Ottawa and Vancouver Laboratories are generally similar, but the work at Vancouver is concerned mainly with the timber species and forest products industries of British Columbia and western Alberta. Programs include both applied and fun-

damental research and they are carefully integrated to provide maximum efficiency from a national viewpoint.

Applied research is directed toward the development of new and improved uses for wood, improved manufacturing practices, and a more complete utilization of the wood harvested annually. Research of a fundamental nature is undertaken to provide basic data on the mechanical, physical, chemical and anatomical properties of wood and its behavior under a variety of conditions. To carry out their functions fully, the Laboratories undertake numerous studies outside their own establishments. These begin in the forest to determine the effectiveness of methods of harvesting timber and they are continued through to operations in converting plants.

Some 145 research projects at the Ottawa Laboratory and 55 at the Vancouver Laboratory are currently active.

Useful results in wood chemistry have been obtained through experiments on the chemical utilization of wood residues by using gases dissolved in organic solvents for the pulping of sawdust and other woody material. The technique permits the production of satisfactory pulps in good yield and in short pulping cycles. Research in the chemistry of red cedar has pointed out the presence of certain chemicals which were unknown in this species. The discovery explained the cause of accelerated corrosion of digesters in kraft pulping of cedar and has enabled corrective measures to be taken. Studies in microbiology and wood preservation are other rewarding phases of the wood chemistry program of the Laboratories.

Timber physics is a relatively new but important field of research at the Laboratories. One notable achievement has been the development of a sonic device for the detection of defective glue-bonds in plywood by non-destructive test methods. The device can be used for quality control in plywood panels as well as to indicate hidden flaws in other materials such as curved plywood, honeycomb core panels, sandwich construction particle boards, and multilayer combinations of wood, metal and plastic.

Timber mechanics has been a major research activity of the Laboratories for many years. Results from continuing studies of the mechanical and physical properties of Canadian woods provide a basis for assessing the strength of timber in various structural applications. Other major studies, in this sphere, include investigations of the strength and other properties of glued laminated constructions and development of suitable engineering formulae and design techniques for use with laminated beams and arches. Closely allied research has led to major improvements in designs of packages and containers.

Information on various factors affecting the sawing of lumber and the peeling of veneer for plywood has been provided through research with specialized equipment at the Laboratories. As a result of this research, some species which had been largely ignored for the manufacture of veneer and plywood were shown to be satisfactory for these products. The development of a laminated circular saw-blade is another achievement of current interest. The blade provides for increased accuracy in sawing and it allows a substantial reduction in waste from sawdust. Technical data from a research sawmill have also been used for courses given to lumbermen to aid them in raising standards of manufacture and reducing waste.

In implementing their research programs, the Laboratories work closely with the forest industries, especially the lumber and woodworking industries. One co-operative study has provided useful information on the effects of tree size and other variables on the conversion of the forest into lumber. Work in developing standards of log quality is also worthy of mention.

Substantial achievements have been made in the field of lumber seasoning but there is still a pressing need for more research results concerning this critical stage in the production of lumber. Research has been directed primarily toward developing and improving drying schedules for seasoning lumber and a variety of other products. Adoption of improved techniques including a new rapid method of high temperature drying should aid industry in the continued improvement of their products. Further advances in methods of seasoning will require additional information on the movement of moisture through wood and fundamental studies of this basic action are essential.

Wood anatomy and wood pathology are two additional fields of forest products research in which considerable work is being undertaken. Research of this kind does not always lead to direct advances or improvements in wood utilization but it provides information basic to an understanding of wood and its performance. Investigations have included identification of pulpwood species by visual inspection and by microscopic examination of the wood, variations in density and fiber characteristics, and deterioration of pulpwood in storage.

Participation on technical committees is another major function of the Laboratories. Their representatives act as chairmen or members of many committees

concerned with forest products. These include committees of the Canadian Standards Association, the Canadian Government Specifications Board, the American Society for Testing Materials, the Forest Products Research Society, and the Food and Agriculture Organization, the Associated Committee on the National Building Code, as well as various committees of trade associations of the forest industries.

Pulp and paper research.

The research program of the Pulp and Paper Research Institute of Canada follows the principle that manufacturing processes include woods operations as well as the actual production of pulp and paper. The same policy has been adopted by individual corporations and it is essential in pulp and paper research for two main reasons. Changes in methods of harvesting wood and the utilization of new species have important influences on mill operations. Similarly, technological advances in the manufacture of pulp and paper have major effects on woods operations.

The pulp and paper industry is carried out under a great variety of geographical conditions with a consequent diversity of logging problems. Each company attempts to develop methods suited to the terrain and to the transportation facilities of its area. The constantly increasing cost of labor has given added urgency to logging research and special emphasis is given to means of mechanization. Through a study which may lead to a new outlook on woods operations, the Research Institute has demonstrated the technical feasibility of transporting wood chips in a water slurry over long distances by pipe line. Interest in full-tree logging has also been stimulated by the Institute, which is currently co-operating in an investigation of the technique. Although this method of logging is not practiced extensively in Canada, it is used with notable success in some other countries, especially the Soviet Union. Widespread adoption here will depend on the development of suitable mechanical equipment and a demonstration of concrete economic advantages.

Changes in the availability of wood and increasing competition have had major influences on research in the technology of pulp and paper manufacture. Many older mills, especially in Eastern Canada, are now far removed from stands of the tree species which they were originally designed to manufacture. Through research, ways have been found to enable these mills to use increasing quantities of other species which are in abundant supply within reasonable distances. Each year, the pulp and paper industry becomes more competitive and if Canadian mills are to retain their markets they must constantly improve the quality of their products and maintain costs at a reasonable level. Research toward achieving these objectives is currently being emphasized and recent developments have resulted in processes which provide higher yields of certain chemical pulps from given quantities of wood.

Research relating to the recovery of waste and the processing of by-products has also received special attention in recent years. One of the outstanding achievements of the Research Institute arose from a study it undertook concerning the recovery of sulphur from waste sulphite liquors. This investigation resulted in the development of "The Atomized Suspension Technique", which has many practical applications in the pulp and paper industry and in the treatment of sewage sludge. "A.S.T.", as it is popularly known, has been successfully tested in the community of Beaconsfield near Montreal and it may be adopted by many municipalities across the nation.

Related research activities.

Although it cannot be strictly described as forest products research, development of specialized machines by certain equipment manufacturers is worthy of note. New types of equipment for logging, barking, sawmilling and secondary processing of forest products have been developed, often in close co-operation with the forest industries. Because of the increasing need for mechanization, it is expected that programs of this kind will be accelerated in the next ten years.

Silviculture and management.

Research in silviculture and management is related to the development of methods of silviculture and management applicable to Canadian forest types and economic conditions. This research requires a great variety of approaches. In the first instance, a sound foundation for silviculture requires studies of the silvicultural characteristics of the individual species and the ecological relationships of the communities in which they grow. Results of such research can only be applied within a satisfactory framework for the classification of forests and forest lands according to productivity and successional development. Hope for improved forests for the future lies in part in expected achievements in the fields of genetics and tree breeding. Systematic management of forested areas requires continued improvements in methods of providing inventories of forest crops and means of determining growth rates and forecasting future yields. Technological advances in the several aspects of silviculture and management bring about a need for new methods of

organizing forest data into plans for silviculture and regulation of forested areas.

The most urgent silvicultural problems in Canada are concerned with the regeneration of stands following cutting. In the past, some of the most valuable stands, such as black spruce and Douglas fir, have originated after catastrophic disturbances. Following cutting, valuable species are replaced to a large degree by less desirable species. Research is directed toward determining the conditions of site, age class, stand structure and forest type where prevailing cutting methods result in unsatisfactory reproduction. Where it is inadequate, research is undertaken to determine which environmental factors are responsible and how they may be modified by cutting or other practices. Many experiments from Newfoundland to British Columbia have been undertaken in the past ten years and effective means of reproducing several forest types have been developed.

It has become obvious that planting is the only practical method of restocking some lands which fail to reproduce after cutting or repeated burning. Planting is not a simple operation and many failures have been encountered. Reforestation research is needed to provide continuing improvements in techniques through the establishment of small-scale trials based on studies of factors responsible for success or failure of existing plantations. It has become evident that the selection of seed trees has an important bearing on the quality of seeds and that the growth and health of planting stock can be improved through the selection of superior strains, the creation of hybrid species, and sometimes the introduction of exotics. This has led to programs in tree breeding and forest genetics. Emphasis to date has been on pine, spruce, Douglas fir and poplar. Experience in planting has also shown that a planting method which will succeed in one circumstance may fail in others. This has led to research directed toward the development of improved planting methods for specific conditions. Plantations present their own peculiar problems of management and several studies of plantation development and treatment have been undertaken by federal, provincial and private authorities. The need for research results as a background for planting programs and management of plantations can be readily appreciated when it is realized that in 1958 the Province of Ontario alone planted more than 16 million trees on Crown lands and furnished an additional 13 million trees to private land owners.

The increasing demand for forest products could eventually result in overcutting of productive lands close to manufacturing plants. Such cutting might bring about long term damage to forest properties and it must be prevented. Research results must be made available soon to provide a firm foundation for high-yield silviculture. To utilize all the wood which a forest stand can produce, repeated light cuttings are required to salvage any trees which are likely to die in the near future. Suitable cutting schedules for this purpose require a comprehensive series of thinning experiments throughout a range of age classes and forest types to establish levels of growing stock and intensities of thinning required to produce maximum yields. Improved forest production can also be achieved by various other means including changing environment through fertilization or drainage, eliminating weed species from mixed stands, and pruning for specialized products of high quality. A limited number of experiments in high-yield silviculture have been completed in the past and some research is currently under way but an intensified program involving more species is urgently required.

Systematic classification of the forest is a basic problem to research in silviculture and management. Forests and forest sites must be differentiated according to productivity and successional development. Almost 25 years ago a broad framework for forest management and research was provided by a geographical description of the forests of Canada. This work remained a standard reference until it was superseded in 1959 by a revised account prepared in light of subsequent information. The second step in forest description is to provide a classification of forests which can be used within geographical subdivisions. Investigations of systems of site classification have been the subject of major research programs by federal and provincial governments. Classifications based primarily on vegetation have been developed in Quebec and British Columbia. These are founded largely on European methods and have been successfully applied. A different approach has been followed by the Ontario Department of Lands and Forests and a classification based on landform, soil, climate, and vegetation has been developed. This classification has attracted world-wide interest and has proven to be a boon to forest research and practice in many parts in Canada.

Silvicultural experiments, like all other experiments, must be based on reasonable working hypotheses. These hypotheses should be founded in part on a knowledge of silvical characteristics of the various tree species, including the reactions of these species to such factors of the environment as light, moisture and temperature. Research directed toward providing such basic information is essential unless advances in silvicultu-

ral research are to be achieved largely through trial and error methods. Past achievements have been considerable and research with more than 20 species is currently going on at the Petawawa Forest Experiment Station and the universities. Nevertheless, a more extensive program is imperative if silvicultural research is to provide results as rapidly as they will be needed.

Many of the problems which confront the silviculturist require for their solution a knowledge of the life processes and mineral requirements of trees. Recognition of this fact has led in the past ten years to an increasing emphasis on research in tree physiology and nutrition. The nutrient demands of species and symptoms of nutrient deficiency are currently being investigated by several organizations. This subject has received special attention at the Pulp and Paper Research Institute of Canada. Physiology of tree flowering is receiving attention particularly in British Columbia and Alberta and at the Petawawa Forest Experiment Station. The latter research is being directed toward finding out how to induce trees to produce seed crops in the years they are most needed. Assurance that seed can be made available when it is required will allow greater latitude in planning of logging operations and a consequent reduction in costs of silvicultural management.

Regulation of orderly wood extraction from forest properties requires reliable information concerning the present status of the forest and the influence of present stand conditions on future crops. Through inventory surveys fairly complete information is provided on cover types, age classes and volumes. Reliable methods of predicting future yields are also a necessity.

In the field of forest inventories research, Canada has been a leader and many of the techniques developed here are in widespread use in several parts of the world. Means of correlating data from field surveys with data obtained from air photographs have been developed. Notable advances have included methods of determining tree heights, crown widths, and stand densities from photographs taken in different seasons and under various conditions. Research in forest inventory is now directed mainly toward improving current techniques of interpreting air photographs and developing stand volume tables.

Problems of estimating future yields of forest stands have presented a major difficulty to Canadian foresters. Methods of preparing yield tables applicable to Canadian conditions have been the subject of large-scale research programs. Techniques developed in Europe have limited application here because the problems of predicting yield in forests recently brought under management are quite different from those in forests which have been under intensive management for a long time. During the past thirty years several methods of predicting yield have been developed and tested. Most have met with only limited success. Research in this field is slow. It requires large quantities of data, many of them collected over periods of ten or more years from permanent sample plots. Since 1945 more than 15,000 plots of this kind have been established by government and private corporations. Most progress has been made in Newfoundland where techniques especially suited to the forests there have been developed. Equally satisfactory results for other areas are expected within the next few years.

Research in several fields of silviculture and management is constantly pointing to needs for improvements in background techniques. Some current efforts are concerned with developing better laboratory procedures for controlled studies of environmental factors on tree growth, mensurational techniques for more efficient measurement of tree volumes, and improvements in statistical designs for silvicultural experiments.

Entomology and pathology.

Insects and fungi are important elements in the forest community at all stages from seed formation to ultimate maturity and harvesting. Attempts to control pest species must therefore be based on knowledge of their intricate ecological relationships. The organization of direct control projects and other practical measures to reduce damage is the responsibility of the owners and operators of the forest resources. Responsibility for providing the information on which effective control measures can be based rests primarily with the Forest Entomology and Pathology Branch, which carries out an extensive program of forest pest surveys and research. The nature of the program and its relationship to control applications can be illustrated by a few typical pest problems.

Among insect defoliators, the spruce budworm is the most destructive in Canada. Large-scale outbreaks have occurred in most regions and heavy timber losses have resulted, principally in spruce-fir forests. The biology, ecology and population dynamics of the budworm have been studied intensively, with particular reference to the role of climate, forest conditions, and natural enemies in the development and termination of outbreaks. Manipulation of parasites and diseases has not yet produced practical results and direct control measures have been needed recently to prevent heavy losses in eastern Canada. Aerial spraying of

insecticides has prevented major timber losses, but there have been unfortunate side effects on fish populations. Moderation of the severity of outbreaks is theoretically possible through forest management practices, but realization of this objective must await large-scale testing and general intensification of forestry operations. Research on insect pathogens is being renewed and genetic means of control are being explored. Chemical control methods are being improved and refined since direct control measures will undoubtedly be necessary from time to time.

Timber decays in mature stands received particular emphasis among early forest disease investigations in Canada. These studies provided information on the kinds and significance of decay fungi and defined methods for assessing decay losses in relation to site, age and diameter of the host tree. They also enable the establishment of cutting schedules based on decay development and the utilization of timber previously considered to be beyond economic salvage. Information on decays is now obtained by provincial forest services and other agencies as a regular part of forest inventory procedures, with the Forest Entomology and Pathology Branch providing guidance on field techniques and interpretation of results. Current research on timber decays is directed toward finding biological and ecological explanations for the frequent sporadic distribution of decay organisms and variability in damage caused by them.

White pine blister rust and Dutch elm disease are examples of introduced diseases that have become very destructive. Eastern white pine and western white pine are both seriously affected by blister rust. Mechanical or chemical elimination of currants and gooseberries (the alternate hosts) provides satisfactory control but is costly and often impractical. Promising results in the United States have been obtained by applications of antibiotics to infected western white pine trees. In Canada, antibiotics are being evaluated for control of blister rust and other tree diseases. The development of resistant trees may be the most permanent solution to blister rust control even though this approach is difficult and time-consuming. Many years of selection and breeding of eastern and western white pines have not yielded varieties completely resistant to blister rust. A few clones, however, have a high degree of resistance and show promise for extensive outplantings. Research is also in progress to clarify ihe infection process and other host-parasite relationships as a basis for the development of more effective control measures.

The Dutch elm disease is now widely distributed in eastern Canada, and substantial reductions in elm populations have occurred in southern Ontario and Quebec. Effective but costly control can be obtained through sustained sanitation and insecticide programs to reduce the numbers of beetles that spread the causal fungus. Research in North America has been disappointing in the fields of chemotherapy and breeding of elms for resistance. Current research on the physiology of the parasite and the host tree may provide new insight into control procedures.

Insects and fungi are active agents in the deterioration of sawlogs and timber killed by fire, windstorms, or defoliation. Studies of the deterioration process have defined the interplay of wood-boring insects and decay-causing organisms in a number of tree species, and have provided a guide to the limits of economic salvage. Damage to sawlogs by wood-boring beetles may frequently be reduced or eliminated by felling or extraction schedules designed to take account of the biology and host preferences of the beetles. Where this is not practical, insecticides may be employed to prevent attack. The Forest Entomology and Pathology Branch and the British Columbia Loggers' Association are investigating more effective and economical means of using insecticides to prevent ambrosia beetle attack in west coast timber operations.

Many insect and disease problems have been encountered in forest-tree nurseries and plantations. In the nurseries, losses from seedling diseases have been substantial. Research on nursery diseases has provided means for reducing losses through soil amendments and chemical applications, aimed particularly at damping-off fungi. However, further research is needed on nursery soils, nutritional requirements of seedlings, host-parasite relationships, and resistance mechanisms, for the development of fully effective control of forest-nursery diseases.

Plantations, especially those of single tree species on depleted soils, have been extensively damaged by root rots, root weevils, cankers, defoliators, tip borers, and nutritional disorders. Some of these problems can be avoided by careful selection of tree species and planting sites and appropriate cultural procedures. Some insect problems can be overcome through the use of insecticides. Pathogenic micro-organisms, parasites and predators offer satisfactory and selective means for the control of certain pest species, especially those of exotic origin. Another avenue is afforded by the selection and breeding of strains of trees resistant to destructive insects or fungi, and progress is

being made by tree breeders in co-operation with entomologists and pathologists.

Forest fire research

Fire is a continuing threat to Canadian forests. About 50 per cent of the total expenditure by provincial forestry departments is incurred for fire protection. Formal research programs in fire control had their beginnings more than 30 years ago and many outstanding results have been achieved. Federal and provincial governments and private corporations have played an active part and a few projects have been undertaken by universities. There is no clearly defined division of fields but in general the federal government has been concerned with determining basic knowledge of fire danger and behavior, and the provincial governments and private industry with developing equipment and the use of aircraft.

A few of the principal accomplishments leading to increased effectiveness of forest fire control are: a system of fire-danger rating now in use in all provinces; methods of determining fire-control standards; procedures for making fire-control plans; surveys and analyses of the causes of forest fires; and means of preparing visibility maps for lookout towers. Development of techniques for fire control by means of aircraft are noteworthy achievements of the Ontario, Saskatchewan, Alberta and British Columbia governments.

The possibility of influencing the weather as an aid to fire control has been receiving considerable study by many agencies in different parts of the world. A current large-scale co-operative project is concerned with obtaining basic knowledge of cloud physics and the precipitation process. It is being carried out by federal, provincial and industrial authorities under the leadership of the Meteorological Branch of the Federal Department of Transport. From the knowledge which will be acquired, it is expected that new and more accurate methods of predicting rain will be developed and that the most promising means of weather modification will be defined.

As one would expect, research in fire control is undertaken mostly in the out-of-doors but laboratory research has an important part to play. In the laboratory, it is possible to study fuel and fire behavior characteristics under simulated conditions. Facilities for studies of this kind are part of recent additions to the Petawawa Forest Experiment Station of the Department of Forestry.

Forest-fire research is similar to all other forest research activities in that it is difficult to place a dollar value on results. Some small indication of research value is provided by one study of hose carried out by the Department of Forestry, in co-operation with the National Research Council which has resulted in annual savings to forest protection agencies amounting to hundreds of thousands of dollars.

Forest economics research.

Research in the economics of forestry is concerned with consumption, distribution and processing of forest products as well as the production and use of the forest itself. It thus provides the basis for intelligent decisions on the economic aspects of managing forest lands and utilizing their products and services.

At the federal level, research in the economics of forestry includes analyses of forestry statistics, studies of legislation relating to forestry, studies of the economic implications of forest management methods and a variety of projects in several other aspects of the field. In the past few years, work has been centered on developing experimental sampling methods for estimating forest production on private lands. Methods which have been devised are being used in five provinces for current studies which will provide a realistic evaluation of the contribution of private forest land to the Canadian economy.

Advances which have been made in developing new products and materials, and changes in consumer preferences, have brought about a growing need for market research studies of the forest products industries. The first of a series of investigations in this important field was begun in 1959.

A significant contribution to the over-all study of the Canadian forest economy was the publication of *The Outlook for the Canadian Forest Industries*, prepared for the Royal Commission on Canada's Economic Prospects. This study was the first of its kind for this country, and to be of maximum benefit it will be followed by reappraisals at periodic intervals. Other principal accomplishments at the federal level have been a study of the costs of sustained yield management; an evaluation of forest fire risks; and an economic analysis of ground rents.

It is well known that the forest industries carry out a great deal of applied research of an economic nature. Several firms have competent economic staffs whose work is largely concerned with marketing and the economics of production.

The need for results from research in forest economics is urgent and the Department of Forestry will stress research in this field. High priority will be given to research relating to the marketing of forest products. Increasing attention is being directed to-

ward the economics of forest site classification and planting. Emphasis is also being given to forecasts of future demands for forest products based on the results of continuing studies of trends in production and utilization.

Wildlife research.

Many mammals which live in the forest and derive their food from it can have a marked influence on forest development. Browsing animals such as moose, deer and rabbits often cause serious damage to reproduction. Small mammals such as mice, voles and squirrels can destroy large quantities of tree seed. Several provinces and the Canadian Wildlife Service of the Department of Northern Affairs and National Resources have large-scale research programs relating to game and fur-bearing animals. These are mostly concerned with gathering information of life histories and population dynamics as a basis for the management of wildlife as a separate resource. To date, there is a limited amount of information on the effects of animals on forest growth but the need for such information is becoming widely recognized. The Research Branch of the Ontario Department of Lands and Forests has undertaken a comprehensive program leading to intergrated management of the forest and wildlife. Browsing of tree reproduction by moose is being studied by the Newfoundland Government and research in control of seed eating mammals has been undertaken by the British Columbia Forest Service and the Canadian Wildlife Service.

Watershed research.

In some countries watershed control through forest management is of paramount importance and the subject of extensive research. In Canada, research of this kind is only beginning although some basic ecological studies are being undertaken. Rapid urbanization and conflicting demands for the use of natural resources are resulting in a pressing need for more research concerning the role which forest management can play in water conservation. Preliminary consideration is being given to a research program aimed at improvement of the water regime on the eastern slopes of the Rocky Mountains.

ACKNOWLEDGEMENTS

Information on research in pulp and paper was provided by Dr. Lincoln R. Thiesmeyer, Pulp and Paper Research Institute of Canada, and statistics on forest research by industry were furnished by pulp and paper companies through Mr. Lowell Besley of the Institute. Data on research personnel were provided by Sir Arthur Gosling, British Forestry Commission; Dr. V.L. Harper, United States Forest Service; Mr. R. N. Johnston, Ontario Department of Lands and Forests; Mr. W.R. Parks, Saskatchewan Department of Natural Resources; and Mr. R.H. Spilsbury, British Columbia Forest Service. Information on research at the four Canadian forest schools was supplied by Prof. J.W. Ker, University of British Columbia; Dean J.W.B. Sisam, University of Toronto; Dean L.Z. Rousseau. Laval University; and Dean J. M. Gibson, University of New Brunswick. Assistance from senior officers of the Department of Forestry is also gratefully acknowledged. Dr. M.L. Prebble prepared the section on entomology and pathology. Col. J.H. Jenkins, Mr. A.L. Best, and Mr. J.C. MacLeod, provided draft material for the sections on forest products research, forest economics and forest fire research respectively and the text was reviewed by Dr. D.R. Redmond.

The Development of the Forest Industries

J.M. Smith,
Partner,
Woods, Gordon & Company,
Management Consultants,
Toronto, Ontario.
and
D.J. Forgie,
Director of Economics and Business Research,
The Ontario Paper Co. Ltd.
Thorold, Ontario.

Canada's forest industries play an important role in both domestic and export markets, and are significant to the development and growth of the nation. The forest industries include all those whose products are made from trees, beginning with the logging industry and proceeding through various stages of manufacturing. These industries had a final product value in 1958 of $2.8 billion. The major portion of this is in fully manufactured form, with relatively little scope within the present marketing framework of increasing the manufacturing component.

Consideration of the dominant forces that have shaped Canada's forest industries and have tended to determine their structural characteristics, provides a necessary bridge between any discussion of available forest resources and estimates of present and potential markets.

The industry conveniently divides itself into two major groups – pulp and paper, and lumber – of almost equal magnitude but with vastly different characteristics. The former group is represented by a small number of large productive units, while the latter is comprised mainly of a large number of small units. Consideration of other dissimilarities and regional relationships provides a better appreciation of the complexity and significance of these two major groups to the national and regional economies.

The corporate structure of the industry and the changing pattern during the postwar period, including mergers and realignments, is of particular significance to a nation such as Canada, which is export oriented and lacks large domestic markets. A fuller appreciation of the intranational and international developments in the corporate organization for producing and marketing forest products, requires a brief discussion of corporate developments within the largest market area, the United States. The United States, while Canada's major customer, produces three times the amount of pulp and paper, including newsprint, produced in Canada.

Regional relationships for major product groups provide an insight into past regional development and future potential.

The fact that Canada has ample forest resources to meet foreseeable needs suggests a potential which, if unused, could be considered in terms of an economic loss. Whether these opportunities can be achieved to a greater degree than anticipated in recent forecasts depends on Canada's competitive abilities throughout the whole range and interrelation of the production and distribution process embracing raw materials, power, labor, capital, and the organization of production and transportation. Canada's past advantages, ranging from a favorable combination of resources to a fortunate proximity to major growing markets, appear on balance to be diminishing or in some cases to no longer exist. This is due to present or past technological and other changes. A clear recognition of market shifts and technological changes and their precise meaning is essential, since Canada can no longer regard its position as one of unique advantage in the forest products field.

The forest industries in Canada constitute an industrial entity that has always had an important place not only in the Canadian economy, where it occupies a leading position, but also in the world resource picture. Some perspective on the development of the Canadian forest industries can be gained through an appraisal of the dominant forces that have determined their product and structural characteristics. Such an approach not only provides a bridge between those background papers concerned with forest resources and policies and those concerned with a quantitative discussion of the size and location of future market, but also provides a basis for assessing the future course of development of these industries. It is essential for the framing of realistic policies to clearly assess the factors that will influence the position that the industries will occupy in the future.

The General Structure of the Forest Industries

The scope of the term *forest industries* in this paper includes all those whose products are derived from trees, up to but not including the point of final conversion or consumption. Broadly speaking, this concurs with the classification system used by the Dominion Bureau of Statistics in its Census of Manufactures reports. By this definition, the operations of forest industries begin with primary forest production, extend through sawmilling and pulp and paper manufacture, and terminate with the output of the wood-using (for example, furniture, hardwood flooring, plywood and veneers) and paper-using industries (paper boxes and bags, roofing paper).

The value of final-product output[1] (or shipments) for this group of industries in 1958 (the latest year for which detailed information is available) is given in Table 1.

The total marketable output of the forest industries group in 1958 was valued at about $2.85 billion. It is of interest to note that $84 million of this output, or three per cent of the total, was marketed in *unmanufactured form* – without further processing within the group in Canada. About $700 million in product value underwent primary processing within the group before being sold – in this instance, largely exported – representing about 25 per cent of final product output. The balance, valued at just over $2 billion and accounting for roughly three quarters of the total, was fully manufactured before leaving the group.

The point of significance in this is not a vital one but it has a bearing on the familiar exhortation, as a rule directed rather vaguely at the Canadian economy as a whole, that more fabrication should be performed domestically. Quite apart from the doubtful wisdom of inducing this – given the size of the domestic market, the similar aspirations of other countries and the practical requirements of tariff negotiations – the implication of the present product structure is that there appears to be little scope for expansion by means of increased domestic fabrication under present conditions.

Table 1. Value of Final Products for the Canadian Forest Industries, 1958

Industry or Product Group	Million Dollars	Per cent
Production of fuelwood, poles and piling, round mining timber and other products	52	1.8
Exports of pulp wood, logs and bolts	32	1.2
Shipments of lumber and sawmill products[1]	407	14.3
Shipments of wood pulp [a]	295	10.4
Shipments of paper and paperboard	765	26.9
Shipments:		
Wood-using industries	797	28.0
Paper-using industries	495	17.4
	2,843	100.0

[a] Shipments here refer to exports plus shipments to domestic consumers or user-industries outside the Forest Industries Group – i.e. shipments for further manufacture *within* the Group are excluded.

Source: Dominion Bureau of Statistics. Wood Products and Paper Products publications.

Possibilities for further declines in the unmanufactured products – fuelwood, poles and piling, etc. and exports of pulp wood, logs and bolts – are distinctly limited and, in any case, would be unimportant. An upgrading of lumber and sawmill products could only occur as a result of further finishing or manufacture of these products before exportation. They would then appear as exports of the wood-using industries but, as a group, these industries are presently not major exporters. The prospects of an upward shift of this nature are not bright. The principal export products in this category are softwood and hardwood plywoods. However, the consideration of foreign tariffs, the existence of domestic industries in foreign markets, or competition from lower cost European and Japanese manufacturers, effectively limit such exports.[2]

An upgrading of wood pulp production would similarly imply further conversion in Canada to paper and paperboard or to products of the paper-using industries prior to exporting. Except for newsprint, all these products encounter foreign tariffs and it is precisely this factor which has limited such development in

the past. Barring the unlikely prospect that this situation will change – and it is not within our power to change it – there is little prospect that exports of the paper group of industries (except newsprint) will provide an opportunity to upgrade from wood pulp now marketed as such.

A further point of interest to be noted from the data in Table 1 is the rough similarity in value of output between the two main industrial subgroups, the lumber group and the paper group. This broad division first becomes recognizable in exports of pulp wood and exports of logs and bolts. The value of final products in 1958 in the lumber group was about $1,204 million and about $1,555 million for the paper group.

Industry Structure

To cite, as comparable magnitudes, the values of final product output of the two main forest products subindustry groups – *lumber and paper* – does not equate them. While it serves to point out that they share or are about equal in the use of the forests at the present time, in most respects they are quite different.

to the lumber group we add the 1,200 very small lumber mills[4], then in 1958 there were just over 11,000 establishments in this group as compared with about 560 in the paper group. Thus, in general, the scale of operations for individual producing units is quite different in the two groups. This is brought out in Table 2.

Certain general statistical similarities do exist, as for example in employment figures. Both industrial subgroups are among the largest employers in Canada: the lumber group provided jobs to about 121,000 persons in 1958 while about 93,000 persons were employed in the paper group. The employment of woods workers is not included in these figures, and it is worth noting that woods operation provide jobs for another 67,000 persons[3]. Thus in total, the forest industries directly employed about 281,000 persons in 1958, equivalent to just over 4.5 per cent of the Canadian labor force.

The major dissimilarities between the two major subgroups occur in the number of establishments. If

A comparison of the size and composition of Canada's lumbering industry on a regional basis is of interest. This is shown in Table 3 which indicates the

Table 2. Establishments, Employment and Net Value of Production in the Lumber and Paper Groups, 1958

	Establishments (Number)	Employment (Thousands)	Net Value (Million dollars)	Net Value Per	
				Establishment (Thousand dollars)	Employee (Dollars)
Wood-Using Industries	4,079	73.2	368.9	90.4	5,043
Lumber Industry [a]	5,769	47.8	236.8	41.0	4,956
Lumber Group [a]	9,848	120.9	605.7	61.5	5,009
Paper-Using Industries	434	28.9	207.7	478.7	7,201
Pulp and Paper	128	64.1	703.0	5,491.8	10,969
Paper Group	562	92.9	910.7	1,620.5	9,799

[a] Does not include lumber mills whose output is less than 15,000 f.b.m. (feet, board measure) or $500 in other sawn products. This will apply to subsequent references in this industry.

Note: Figures may not add because of rounding. Source: Dominion Bureau of Statistics.

Table 3. Lumber Industry, Regional Breakdown of Mills, Employees and Value Added by Manufacture

	Number of Mills	Average Number Employees per Mill	Average Value Added by Manufacture Per Mill
			($'000)
Atlantic Provinces	1,364	3.8	10.4
Quebec	1,287	5.8	21.3
Ontario	802	6.5	29.6
Prairies	890	3.1	10.2
British Columbia	1,418	19.1	114.3
Yukon and N.W. Territories	8	6.0	28.9
	5,769	8.3	41.0

Source: Dominion Bureau of Statistics. *The Lumber Industry*, 1958.

number of mills, the average number of employees per mill and the average value added by manufacture per mill in each major region. The table points up clearly the greater size and output of West Coast mills.

Table 4 illustrates the trends in number of establishments and employment in the lumber and paper groups for the 1951-58. The data do not permit general observations beyond the rather obvious one that the lumber industry has shown market declines in recent years – both in establishments and employees – in contrast with the other groups.

Table 4. The Forest Industries Number of Establishments and Employment in the Forest Industries, 1951–58

	Number of Establishments			
	Lumber	Wood-Using	Pulp and Paper	Paper-Using
1951	7,934	4,041	126	421
1952	8,283	4,184	128	415
1953	8,194	4,268	127	428
1954	7,696	4,469	125	444
1955	7,333	4,471	125	455
1956	6,629	4,574	126	442
1957	6,276	4,520	128	454
1958	5,769	4,079	128	434
	Number of Employees – Thousands			
	Lumber	Wood-Using	Pulp and Paper	Paper-Using
1951	62.4	69.2	57.3	25.6
1952	60.9	79.6	57.8	25.2
1953	60.9	73.4	58.2	26.2
1954	57.0	72.0	60.8	26.5
1955	58.6	74.0	62.2	27.5
1956	57.1	78.8	66.0	27.7
1957	50.7	76.3	65.9	28.3
1958	47.8	73.2	64.1	28.8

Source: Dominion Bureau of Statistics.

From the 1952 peak, the number of lumber establishments had decreased by nearly a third by 1958, while the number of employees fell by almost a quarter. The decline in establishments can largely be attributed to the demise of smaller units in the industry. This trend is indicated in Table 5.

It is evident from the data in Table 5 that the average output of incorporated companies is much larger than that of the other establishments. This category is the only one to show an increase in establishments and the decline in net value of production was relatively much the smallest. A long-standing feature of

Table 5. Lumber Mills by Type of Ownership, 1952 and 1958

	Number of Establishments		Net Value of Production ($000)	
	1952	1958	1952	1958
Individual Ownership	5,565	3,782	29,284	17,053
Partnerships	1,791	993	12,828	5,554
Co-operatives	22	9	606	301
Incorporated Companies	905	985	83,065	71,143

Source: Dominion Bureau of Statistics. *The Lumber Industry, 1952 and 1958.*

the lumber industry has been the great number of small operators. These were often almost nomadic in character and they had little interest in the perpetuation and improvement of forest resources. While we would not claim that relatively large operators – generally the incorporated companies – invariable practice good forestry, there is a general tendency in this direction, motivated if for no other reason by an interest in preserving capital investments. The movement toward larger units of production can, in this respect, be viewed as desirable.

There is little doubt that this development has improved productivity in the industry. The data in Table 4 revealed that employment had declined by about one-quarter during the 1951-58 period. As between these two years, lumber production in f.b.m. (feet, board measure) rose by about 5.5 per cent. There was thus an apparent gain of roughly 30 per cent in production per worker. No doubt some of this gain occurred in the *usual* way – that is, from the use of more and better equipment and methods. But this, in turn, undoubtedly occurred in the course of the shift toward larger units of production – in effect, a shift from lower to higher productivity operations. In 1958, the net value per worker in incorporated businesses ranged from 36 per cent to 65 per cent higher than in the other categories shown in Table 5. The capital investment in this group also tends to be much greater with the greater mechanization and modern equipment required for large scale operations.

In regard to the paper group, we noted earlier the tendency for the number of establishments and more noticeably, employment, to expand. Comparative da-

Table 6. Indices of Employment, 1951–1958 (1951 = 100)

	Lumber Group		Paper Group		All Manufacturing
	Lumber	Wood-Using	Pulp and Paper	Paper-Using	
1935–9	48.7	43.0	53.2	42.6	49.5
1951	100	100	100	100	100
1952	97.5	115.0	100.9	98.4	102.4
1953	97.5	106.0	101.6	102.3	105.5
1954	91.3	104.0	106.1	103.5	100.8
1955	93.9	106.9	108.5	107.4	103.2
1956	91.5	113.9	115.2	108.2	107.5
1957	81.3	110.3	115.0	110.5	108.0
1958	76.6	105.8	111.9	112.5	108.0

Source: Dominion Bureau of Statistics.

ta on employment in the group relative to the lumber group and to manufacturing generally are given in Table 6.

Since the prewar period, wood-using and paper-using industries have more than kept pace with the general expansion of employment in the manufacturing sector of the economy. As for the pulp and paper industry, while a slight gap existed between its trend of employment and that for "all manufacturing" during the early 50's, more rapid growth in the industry has narrowed the gap and it has tended to match the "all manufacturing" trend in recent years. The opposite is true of the lumber industry where, as discussed earlier, employment declined fairly consistently through the 1950's.

Regionally, the historical development of the forest industries in Canada has roughly paralleled the industrial development of the country. Beginning with the first cuttings in the eastern white pine forests for British masts, the industries grew along the inland waterways, jumped to the West Coast and then began to backfill in the Prairies. The pattern of regional expansion and the current distribution of production, as reflected by primary forest production, are shown in Table 7.

Table 7. Primary Forest Production by Regions, 1922–4 and 1956–8, in Millions of Cubic Feet and Percentages of Total

	1922–4		1956–8	
	Millions of Cubic Feet	Per cent of Total	Millions of Cubic Feet	Per cent of Total
Atlantic[a]	274.7	13.3	416.5	13.2
Ontario-Quebec	1,233.9	59.7	1,464.7	46.2
Prairies	133.4	6.5	227.0	7.2
West Coast	424.9	20.6	1,058.2	33.4
Total	2,666.9	100.0	3,166.4	100.0

Source: Dominion Bureau of Statistics.

[a] Newfoundland production is not included in the 1922–4 data. This Province accounted for only three per cent of total production in 1956–8 the relative shares of the regions are only slightly affected by its inclusion in the later period.

Corporate Structure In The Industry

In considering the corporate structure in the industry we must keep in mind the differences already noted between the lumber and paper groups. The number and average size of establishments have already been documented in Table 2. These differences along with product groups, markets, and historical development all play important roles in understanding the structure of the industry, and the development of regional growth. In the case of the lumber industry, as already noted, the use of averages in considering size can be misleading. With a total of almost 7,000 establishments (including about 1,200 very small mills) the Dominion Bureau of Statistics reports that in 1958 only 14 reported production in excess of $5 million. These 14 accounted for almost one-quarter of the industry's gross value of production and are concentrated on the West Coast.

The larger corporate entities, both in lumber and in pulp and paper, have achieved of necessity a high degree of vertical integration from tree to finished product. This type of integration is an inherent characteristic in pulp and paper manufacture, where there are substantial manufacturing savings in a continuous

process converting wood through pulp to finished paper and board. The decline and disappearance of the so-called *livelihood* wood pulp mills – non-integrated woodpulp producers – attests to the marginal nature of the non-integrated producer. The desire to obtain and develop an assured supply of basic raw materials, on the other hand, has long been a basic motivating factor for the inclusion of logging as part of the manufacturing process for the larger producers in both the lumber and pulp and paper groups.

Extension of vertical integration by lumber and pulp and paper mills to embrace subsequent stages of manufacture or conversion, through acquisition as well as by development, has been increasingly common *during* the postwar period, although it has possibly not reached a point where one could classify this as typical of the entire industry. The large West Coast lumber mills have long since extended their operations forward to include additional stages of manufacture, particularly in the production of plywood and veneers and in the utilization of waste products. These mills have also diversified into pulp and paper and, during the postwar period, a steady program of modernization, expansion and consolidation has been undertaken by the larger manufacturing organizations.

The logic of such developments has been imposed on the one hand through the growth and changing structure of the markets for wood products, and on the other hand through the savings available from a more balanced and complete use of raw material resources.

Turning to Eastern Canada where the production of export newsprint is dominant, we find a somewhat different pattern of development. The purpose of vertical integration is either to assure sources of raw material for manufacture, or to maintain a stable and satisfactory level of operations through an assured market. In the case of newsprint the latter objective has historically been achieved through long-term contracts with publisher-consumers. In some cases the integration extends back from the newspaper publisher to assure a supply of the raw material, through publisher participation in newsprint manufacturing. But in general, by the nature of the product and the location of its major markets, extension of the integration process by the manufacturer to final market levels does not apply to newsprint in the same manner that it does in the other forest product groups.

This basic difference is important in evaluating the developments in the structure of the paper products industry since World War II. Developments in the form of mergers and acquisitions have been possibly more apparent in the United States than in Canada, because the emphasis there is in the manufacture of paper and paperboard grades other than newsprint. In Canada, if paper and paperboard production were divided into eight parts, six would be newsprint while paperboard and other paper grades would represent one part each, mainly for domestic consumption. In the United States, paper and paperboard form equal parts but newsprint accounts for only about one-eighth of paper output.

The extension of integration to the market level in many paper and board grades became significant in the mid-'fifties when competition, intensified by cyclical conditions, made it desirable for vertically integrated board producers, particularly in the United States, to enter the converting field in order to assure markets. The same pressures existed within the structurally similar domestic Canadian industry, but, as noted, this industry is relatively very much smaller.

Action such as the above has immediate secondary effects as major consumers, previously supplied from various outside sources, cease to be a source of market demand. Unless similar acquisitions are also made by other large competitive producers, it is apparent that they would find themselves with greatly reduced market opportunities. This is a general description of the active merger program as it developed in the major producing-consuming market for paperboard products, the United States. The domestic Canadian market, lacking the size and breadth of the United States market, has not felt these pressures to the same extent, but the record of corporate acquisitions and realignments testifies to the fact that this has also been an active process in Canada.

In any event, the greater degree of integration between producer and consumer, both in the United States and domestically, has had direct implications for the Canadian industry. One effect of this is that, while pulp consumption has grown steadily in the United States as well as in other markets, the consumption of *market pulp,* that is, pulp purchased by consumers from non-integrated producers, has been dwindling steadily as a percentage of the total.

A second tendency has also been apparent in recent corporate developments. Technological advancements have lent encouragement not only to diversification but also to be the development of very large corporate units resting on a broad product base. In the United States this has been reinforced by the breadth and of consumer markets, providing a greater opportunity to utilize corporate management and marketing facilities and to develop an integrated corporate complex which obtains the resource, carries out research and development, manufactures the

products, converts, and ultimately becomes involved in the actual distribution process at the consumer level. Examples of the fully integrated, widely diversified, corporate structure are available both in Canada and the United States. The larger manufacturing entities have ceased to be producers of lumber on the one hand or paper products on the other, but instead are highly integrated and diversified organizations producing a full range of forest and related products – pulp, newsprint, paper, tissue, paperboard, lumber, laminates and chemicals. Another characteristic is the development of nation-wide marketing outlets with less dependence on regional marketing. A further extension of this has been the tendency of larger companies in the United States and the United Kingdom to set up international manufacturing and marketing structures.

The extent of foreign capital participation in the Canadian forest industries might be briefly noted. Certain reports of the Dominion Bureau of Statistics provide, for a number of industries, the percentage of capital employed that is controlled in Canada, the United States and in all other countries. Among the forest industries only the pulp and paper industry is reported separately. According to the Bureau reports, which give 1957 as the latest year, some 45 per cent of the capital employed in pulp and paper is controlled in Canada, 43 per cent in the United States and 12 per cent elsewhere, primarily the United Kingdom. These proportions are closely similar to those prevailing in Canadian manufacturing industries generally and, in regard to the foreign capital percentages, are considerably below the proportions in the two other major resource sectors that are reported, the petroleum and natural gas industry and mining.

To consider the subject in detail is beyond the scope of this paper but the observation might be made that it is surprising that foreign ownership is not proportionately higher, given the close association with foreign markets that a heavy dependence on exports implies and the tendency for vertical integration in order to maintain an assured source of raw materials. In another aspect, it is evident that the investment in the industry by overseas and American investors has assisted in its growth, not only in the provision of the capital itself, but in providing assured markets or a strengthened access to foreign markets through the sales and distribution facilities of parent companies.

It will be apparent that products, markets and trading policies all have had distinctive effects on the size and nature of the corporate structure of Canada's forest products industries.

The economic pressures of the modern world are such that manufacturers are obliged through technological and product development to obtain maximum use of raw material resources at the one end and to extend their operations into marketing and distribution activities at the other. The implications of this on a nation such as Canada which is export-oriented and lacks large domestic markets poses particular problems and challenges.

Product Structure

At one time, lack of forest resources to meet growing regional markets forced manufacturers in the United States to turn to Canada, the nearest logical source of supply. They came during the latter half of the 19th century for lumber, and during the first half of the 20th century for lumber, pulp and newsprint.

The development of a market for manufactured products in the United States took the form of pulp exports when pulpwood ceased to be available for export, sawn lumber when sawlogs could not be exported, and eventually newsprint to serve the growing presses of the northeast and midwest when newsprint became eligible for duty-free entry into the United States in 1911.

Our forest product markets have in the past, therefore, grown out of a need in the consuming areas for raw materials not economically available in the consuming country. And in the United States the customs-tariff structure developed in a manner permissive of imports of wood or wood fibre in its least-manufactured form. It might be added, too, that certain Canadian enactments after the turn of the century were designed to discourage or prevent export of raw wood. This approach was adopted in an attempt to encourage increased manufacture of resource materials within Canada. No doubt this action had a significant role in the early development period of the Canadian pulp and paper industry, but its effectiveness as a policy technique should not be exaggerated. Other factors, peculiar to the times, helped to make the policy successful in this particular application. U.S. attitudes were divided: wood pulp consumers, then more commonly purchasers of market pulp, were not averse to the Canadian policy in that it provided a second, and potentially competitive, source of supply. The same is true of newspaper publishers in the U.S. who also favored the development of a second source of supply. Moreover Canada offered other advantages for the location of low-cost production.

93452–48½

Table 8. Distribution of Canadian Lumber, Woodpulp and Newsprint, in Physical Quantities, 1958

	Sawn Lumber		Woodpulp		Newsprint	
	Million Cubic Feet	Per cent	7,000 Tons	Per cent	7,000 Tons	Per cent
Exports	3,824	55.8	2,134	21.1	5,683	94.2
Used by wood – or paper-using industries	1,813	26.4	7,944	78.4	–[a]	–[a]
Used by other than the Forest industries	1,220	17.8	69	.5	348	5.8
Production	6,856	100.0	10,147	100.0	6,031	100.0

[a] - negligible.

Source: Derived from Dominion Bureau of Statistics data.

Turning to specific products, the *big three* of the forest industries group are, of course, newsprint, wood pulp and sawn lumber. For each of these, the high levels of output that have been attained are largely attributable to export markets. The statistical measure of this is shown in Table 8.

In the case of wood pulp, much to the tonnage used by the paper-using industries – roughly 5.8 million tons – goes into the manufacture or newsprint. Thus between 75 and 80 per cent of Canadian wood pulp is ultimately exported as pulp or newsprint. The same kind of situation arises where other products of the paper-using industries are exported or, in the lumber group, where products of the wood-using industries are exported, but the volume of such exports are negligible in relation to the over all figures shown.

On a market value basis, sales of sawn number, wood pulp, and newsprint to consumers or user-industries not in the forest industries group were about $1,355 million in 1958. Imposing as this figure is, however, it accounted for less than half – about 47 per cent – of the total value of final products marketed by the group in that year. The fact is that there has been an ever-increasing diversification of forest products and particularly rapid expansion in some lines – notably, for example, the packaging field – so that, relatively, the importance of other products has grown. Yet, at the very least, this growth has been greatly facilitated by the existence of the *big three* in the sense that they provided a base – in terms of resource development, technical know-how, skilled manpower and investment capital – on which a diversified domestic industry could be built.

It is also significant that these products – newsprint, pulp and lumber – account for 51, 22, and 21 per cent respectively of our total forest product exports, while all other paper and board exports combined represent only 2½ per cent of our forest product exports, and primary forest products account for only slightly more than three per cent.

Canadian newsprint, wood pulp and lumber are sold principally in only two countries – the United States and the United Kingdom – as Table 9 indicates.

Table 9. Percentages of Newsprint, Wood pulp and Lumber Exports to the United States and United Kingdom, 1958.

	Exports to: U.S.A.	U.K.	Total Exports U.K. and U.S.	Total Other Markets
			– per cent –	
Newsprint	85.5	6.2	91.7	8.3
Pulp	84.0	8.6	92.6	7.4
Lumber	79.3	11.1	90.4	9.6

Source: Dominion Bureau of Statistics, *Canadian Forestry Statistics*.

Regionally, newsprint manufactured for export in Eastern Canada, including the Province of Ontario, is shipped to U.S. Midwest markets, Northeastern and Atlantic Coast Markets, or overseas. One detailed survey of the United States market showed that mills in Quebec, New Brunswick, Nova Scotia and Newfoundland shipped mainly to New York, New England, Pennsylvania, South Atlantic and Gulf ports. Ontario mills shipped to Illinois, Ohio, Michigan and Indiana, while British Columbia mills shipped to Pacific Coast ports, to Texas, Oklahoma and inland ports of the Pacific Coast states.

While these regional patterns of newsprint shipments have tended to shift somewhat with the introduction of new capacity in the southern United States, the significant point is to recognize the importance of capacity-location in servicing markets which are regional rather than national in scope. The percentage breakdown of Canadian shipments by producing regions in Canada is shown in Table 10. The importance of resources as a locational factor cannot of course be minimized, but the interaction of location and regional market considerations can be better appreciated in a review of Table 10.

Table 10. Estimates of Newsprint Shipments to The United States and Canadian Markets by Regions

Produced in:	Total	Shipped To:		Others
		U.S.A.	Canada	
		— per cent —		
Quebec and Atlantic Provinces	65	50	4	11
Ontario and Prairie Provinces	25	23	2	neg.
British Columbia	10	8	1	1
Total	100	81	7	12

Source: Derived from data published by Dominion Bureau of Statistics and Industry Sources.

Almost one-half of Canadian newsprint shipments in 1958 originated in Quebec and the Atlantic Provinces, those areas in closest proximity to the large newsprint markets of the eastern United States. In British Columbia, limitations imposed by a lack of regional markets inhibited the early development of newsprint production, but it has since attained appreciable size and more rapid growth rates than the eastern provinces. It now accounts for about 10 per cent of total shipments. It will be noted, too, that only in the Quebec and Atlantic regions are exports overseas a significant proportion of total regional newsprint shipments.

In Table 10, the Prairie Provinces, with one mill in Manitoba, have been grouped with Ontario. While wood resources are available in the Prairie Provinces, regional location of markets and other factors have not as yet been such as to permit or encourage industrial development of pulp and paper in this area. This is not to suggest that, in the future, growing North American markets, available resources of energy in the Prairies and other changes in basic factors affecting location may not alter this situation.

Largely because of the necessarily close association between paper and pulp mills, wood pulp and paper production is geographically located in the same major producing areas. The major pulp consuming markets of the United States supplied from Eastern Canada are located in or close to the heavily populated and industrial areas of the northeast and midwest United States. The West and southwest are logical markets for west Coast producers although traditionally a considerable quantity of pulp in the United States markets moves from west to east.

The lumber trade, because of differences between West Coast and eastern timber — in both size and species — has a different geographic structure. Assisted by favorable rail rates, West Coast dimension timber and plywood are consumed domestically across the country while eastern lumber is mainly restricted to smaller structural timbers. British Columbia by the very nature of its forest resources is the major source of Canadian exports although, relative to their smaller lumber industries, exports are also of regional importance to other provinces and areas.

Canada's greatest forest products customer is the United States, a nation whose forests were once badly depleted, but which now has large reserves of accessible forest. While we rightly think of Canada as the world's foremost newsprint producer, it is well to remember that our major customer produces three times the total quantity of pulp and paper (newsprint inclusive) produced in Canada.

In terms of industry export statistics, as noted earlier, the United States is considered as an entity, whereas it is not one, but several, distinct markets. The greatest growth in the United States is now taking place in the South and West — two regions which have not been natural market areas for eastern Canadian producers and which have not yet been relatively large areas of demand. With government assistance during the postwar period of short supply, domestic newsprint production in the United States was encouraged. Expansion began in the southern United States to meet growing regional markets. The regional shift in U.S. demand is further noted in the expansion of Canadian West Coast newsprint capacity to meet increased U.S. West Coast demand. The shift in capacity location is shown in Table 11.

Table 11. North American Regional Newsprint Capacity and Growth, 1949, 1956 and 1960

	Newsprint Capacity (1000 tons)		
	1949	1956	1960
CANADA			
Atlantic Provinces	823[b]	939[b]	992
Quebec	2,683	3,200	3,557
Ontario	1,143	1,395	1,918
British Columbia	453	725	1,144
Total, Canada[a]	5,102[b]	6,259	7,611
UNITED STATES			
Southern U.S.A.	120	507	1,200
Other U.S.A.	736	1,083	1,205
Total U.S.A.[a]	856	1,590	2,405

[a] Totals do not add because of rounding.

	Regional Growth Index (1949 = 100)		
	1949	1956	1960
CANADA			
Atlantic Provinces	100[b]	114[b]	121
Quebec	100	119	133
Ontario	100	122	168
British Columbia	100	160	253
Total Canada	100	123	149
UNITED STATES			
Southern U.S.A.	100	423	1,000
Other U.S.A.	100	147	164
Total U.S.A.	100	186	281

[b] Includes, for comparative purposes, 485,000 tons from two Newfoundland mills.

Source: American Newspaper Publishers Association Bulletins Showing Individual Mill Capacities.

As a producer of pulp, Canada has been a complementary supplier providing market pulp to meet, in part, the raw material needs of paper and board manufacturers. Information in Table 12 indicates the relative importance of Canadian market pulp grades supplied to the United States in comparison with the United States sources of supply.

The United States Treasury Department definition of newsprint for tariff purposes includes a definition of stock – groundwood, unbleached sulphite or bleached or semi-bleached sulphate – in limiting proportions. These are the grades, particularly groundwood and sulphite, which are the natural potential by-product of the newsprint industry with capacity excess being sold as market pulp. But during the postwar period there has been a growing demand for quality improvement – improved strength or a cleaner or whiter product to meet the competitive demands of consumer markets for paper cups, food and container boards, sanitary tissues and so on. This has resulted in a relatively rapid expansion of demand for stronger kraft pulps and bleached grades and a decline in the markets for unbleached grades and sulphite pulps.

With respect to sawn lumber the United States has become the leading softwood importer, replacing the United Kingdom. Most of the volume imported by the United States in 1958 was supplied by Canada whereas the bulk of imports by the United Kingdom came from Sweden, Finland and the U.S.S.R., representing about 71 per cent as against only 17 per cent from Canada.

With respect to plywood, the United States continues to be the leading importer, taking 40 per cent of the world total. U.S. plywood imports in 1958 came mainly from Japan and the Philippines which together supplied 84 per cent of the total. Only five

Table 12. Sources of United States Market Wood pulp Supply, 1959

From / Grade	Canada		U.S. Domestic		Europe		Total
	7,000 Tons	Per cent	7,000 Tons	Per cent	7,000 Tons	Per cent	Per cent
Bleached and Semi-Bleached Sulphate	509	43	573	48	103	9	100
Bleached Sulphite	209	29	408	56	112	15	100
Unbleached Kraft (sulphate)	106	35	76	25	118	40	100
Unbleached Sulphite	75	44	23	14	70	42	100
All Paper Grades of Pulp	1,059	39	1,222	45	434	16	100

Source: U.S. Pulp Producers Association

per cent came from Canada, a sharp contrast with the 1948 pattern when 92 per cent of U.S. imports came from this country.

Competitive Factors And The Future

With this background of the structure and characteristics of the forest industries we turn now to some of the major factors that will determine the future ability of the Canadian forest industries to compete effectively in world markets. The availability of wood to the industry has been dealt with in considerable detail in a separate paper covering the *Potentialities of the Resource Base* by D.V. Love. Suffice it to note here that raw material resources are not a limiting factor to the expansion and development of Canada's forest products industry. As the Gordon Comission's estimate to 1980 has shown, Canada can anticipate utilization of only 52 per cent of the allowable cut in that year, and until that time it also appears that United States resources should be sufficient to meet their needs, leaving an ample supply of forest resources available for continental market requirements.

The conclusion that Canada's forest resources are ample for any demands that might foreseeably be placed on them is in a sense more disquieting than comforting. It indicates a substantial under-use of resources which can be considered in terms of an economic loss. It can be argued, of course, that the unused resources do not perish, that a higher rate of utilization is not *per se* a meaningful objective. Indeed it would be physically possible to so increase the forest yield that utilization could be increased without appreciably raising the percentage of allowable cut that is used. But it can also be argued that a relatively low rate of use, in broader terms, is an indication of unrealized potential and a loss in terms of employment opportunities and foregone income.

The essential point is that forest products, like any other, must be marketed domestically or abroad at competitive prices. In the home market, the sources of competition are primarily competing materials. Import competition is of consequence only in such products as furniture and hardwood plywood; much more serious are the competitive inroads from other structural materials and plastics. In foreign markets, where some 50 per cent of the value of final products is marketed, not only will the familiar competition of the Scandinavian forest industries be met but also new and increasing competition may come from Russia and, in the longer run, the less developed countries.

In the course of ultimately bringing products to the market, the whole range of the production and distribution process is involved: raw material, power, labor, capital, the organization of production and transportation. Historically, the growth of our forest industries to their present scale can only be understood in conjunction with the growth of the markets in the United States. And in relation to that market, Canada has enjoyed distinctive advantages in the over-all marketing process. It had abundant accessible resources at a time when this was not true of the United States, particularly the big north-central and eastern consuming areas. Canada had an abundance of cheap hydroelectric power. It also had skilled manpower and, as a result of American participation, investment capital was not a problem. Finally, our forest industries had the great advantage of close proximity to the U.S. markets.

Looking ahead, the future growth of our forest industries must be viewed in the broader context of world markets. We may indeed anticipate that Canadian shipments of forest products to the United States will grow: it will remain far and away our largest market. Yet in relation to that market, our advantages have tended to narrow. Moreover, the *growth* markets of the future lie elsewhere and in relation to these markets our advantages largely disappear.

We have noted earlier that the forest resource situation in the United States has been improving. In addition, advances in technology have brought less exacting requirements on wood resources. The use in papermaking of southern pine, hardwoods and tropical woods is an example of how the species base has been broadened. In the lumber field, the development of laminates and composition boards achieved a similar result, as applied not only to species but also to timber size.

In regard to hydroelectric power, our differential cost advantages will predictably narrow. The sources of Canada's electrical energy supply have been projected by one authority in the following ratios:[5]

Source	*1955*	*1980*
Hydro	96	70
Steam	4	20
Nuclear	0	10

All three sources will expand in absolute terms but steam and nuclear sources are expected to gain relatively with the latter likely to be the fastest-growing source by 1980. In general, Canada will have no comparative advantage in these fields and may, in fact, be at a disadvantage in relation to some other countries due to relatively high construction costs. Furthermore, in regional areas such as Ontario, which

have developed a large proportion of available sources of low cost hydro power, average power costs will tend to rise more rapidly with the continuous introduction of higher cost power sources. This has further implications in the loss of present comparative advantage for these regions and for particular areas within the region.

The complexities of labor and capital requirements cannot be the subject of extended discussion here. The essence of the problem can only be stated: that the relationship of our money wages to those in virtually all overseas countries is far out of line with the value relationship of our currency to theirs. Further, this is not compensated for by higher productivity in the forest products industry, since essentially comparable production techniques are in use in all major producing countries.

The long term implications of the problem are reasonably clear. One is that, relatively, pressures are exerted on Canadian wage and exchange rates to fall or on those of other countries to rise. There are, however, many other factors to be considered so that this result is by no means predictable nor can it be anticipated. A second implication is that a high rate of capital investment might be required by the Canadian industries in an attempt to realize greater relative gains in productivity. This would likely prove unsuccessful in the long run since, as just noted, comparable techniques tend to be available to all and Canada already has an extensive investment in plant and equipment. Still another implication, and one that is implicit in the comparatively slow growth rate projected for the forest industries group, is that growth will be restrained to some extent by foreign expansion and competition.

In the organization of production, we need not anticipate a worsening of the position of the Canadian forest industries. With the exception of our major export sectors, newsprint production, large scale lumber operations and the manufacture of woodpulp, it has been difficult for Canadian industry to develop efficient productive units as compared with other countries and this has been a characteristic problem. This is the result of certain inescapable physical factors: a small and widely dispersed domestic market which limits access to economies of scale, slow-growth forests that require logging over extensive areas to supply a given volume of wood requirements, and a difficult climate that imposes an undesirable seasonal variation on work practices. In the past, factors such as these have had to be overcome or compensated for by advantages elswhere in the over-all process. It is rather likely that the disadvantages these factors collectively impose will diminish in the years ahead, but improvement, if it comes, is likely to be slow.

The competitive position of Canada's forest industries – and, therefore, the industries' development prospects – will be greatly influenced by transportation costs. We have seen the profound effect that the location of the U.S. market has had on the growth of lumber, wood pulp and newsprint production in Canada.

Long-range projections of U.S. requirements anticipate that further increases in demand will be directed to us from that source in future, these increases are reflected in the wood requirements prospects set out by the Gordon Commission. Here we are concerned that the prospective roundwood requirements in Canada will not be sufficient in relation to our resource potential and in this sense will result in an inadequate expansion of employment and income in relation to what the resource base is capable of generating. As was indicated earlier, we must look elsewhere for additional demands if our utilization ratio is to be raised.

In themselves, these potential markets are not hard to find. There is much to suggest that the European nations, with the dynamic growth that has been obvious in recent years, are in the course of breaking through to U.S. consumption standards – and this could give entirely new dimensions to their wood requirements. Similarly, the long-run possibilities for the growth of consuming markets in the under-developed countries are distinctly favourable. The important thing to note, however, is that we are separated from markets of Europe and elsewhere by at least three thousand miles. The advantage of proximity is no longer ours. (This aspect of lumber prospects is covered in detail by the Conference paper *Demand Prospects for Forest Products* by D.A. Wilson).

In conclusion it now remains to state the position to which this general background has brought us. We have had in the past unique advantages in the forest products sphere: advantages that ranged from a favorable combination of resources to a fortunate proximity to the major markets in the United States.

On balance, these advantages seem to be diminishing or are no longer present. Technological advance has made it possible to use a wider range of raw materials in regard both to species and size, and this has tended to favor the forest industries of other countries. On the market side, the areas where growth

in requirements for forest products is expected to be the most rapid do not lie close at hand. This is especially true of the overseas markets, but even in the United States market growth will be greatest in the south and southeast where our locational advantages are least.

The future development of our forest industries then, must depend on our ability as an industrial nation to compete effectively and to recognize the reality of the market shifts and technological changes now occurring. No longer can we regard our position as one of unique advantage in the forest products field.

Notes and References

[1] Final-product output relates to the value of products marketed at successive stages of manufacture by the forest industries group to consumers or user-industries not in the group. Except for minor statistical difficulties, the estimates do not suffer from double counting as related to the forest industries, but the total cannot be used to show, for example, the contribution of the group to G.N.P. (gross national product) . Its chief value is to reflect the product structure of the group and the flow of products at successive levels.

[2] See *The Outlook for the Canadian Forest Industries*, Royal Commission on Canada's Economic Prospects, pp. 74-76.

[3] This figure is an estimate prepared by the Bureau of Statistics from sample data. It does not include those engaged in the transportation of logs.

[4] Those whose lumber output was less than 15,000 f.b.m. or other sawn products amounting to less than $500 in the year. These are not included in the Bureau of Statistics' reporting of the activities of the lumber industry.

[5] *Canadian Energy Prospects*, John Davis, Royal Commission on Canada's Economic Prospects. These projects, of course, represent the prospects nationally. In *Power and Population*, a survey prepared by Messrs. Baltzer and Convey of the Department of Mines and Technical Surveys, the observation is made that "Hydroelectric power will continue to play its very important part in attracting industries consuming large blocks of power. The Northern Sub-Artic and the forest zones of Labrador, Quebec, British Columbia, and the Yukon will make the largest contribution to hydro development". In some locations, Canada still offers the combination of available wood resources and potentially cheap power. But with some exceptions, the North Shore of the St. Lawrence, for example, such locations are likely to be less favorable in relation to markets.

Review and Assessment of Present Forest Policies

W.A.E. Pepler,
Manager, Woodlands Section,
Canadian Pulp and Paper
Association, Montreal.

The use made of forests is the resultant impact of all actions, or lack of action, in a number of relevant policy fields—labor, taxation, foreign trade, land use, recreation, and so on. If most of the controllable actions were co-ordinated, the result would be a forest policy. This is therefore something much broader in scope than mere forest management *policy which does not look far beyond the forest itself.*

The objective of forest policy should be to secure for the economy as a whole the greatest possible present and future benefits consistent with the balanced exploitation of all resources. This implies multiple use of the forest and its development at a rate consistent with the probable demands upon it within the predictable future.

Forest policy should be appropriate to any prevailing stage of economic evolution. As the demands made upon the forest become greater and more complex and as old-growth forests are supplanted by managed ones, the control of forest exploitation should move successively through protective, supervisory, and developmental phases. Within a given province, all three levels of control may be needed concurrently in different regions.

As stated above, the components of a forest policy cover a wide range of major topics. Policies with respect to each of these must not only be made to harmonize with the central aim but also have a degree of flexibility permitting their consistent and effective application to any and all prevailing regional requirements of forest management.

In Canada we have fairly well conceived and quite similar forest management *policies in most provinces, but even a rudimentary* forest *policy is hard to discern—if one indeed exists. It is as though we had tactical procedures galore with no strategy worthy of the name to co-ordinate them.*

The situation in this country is such that only government can take a leading role in establishing badly needed forest policy, but forest owners and the forest industries also have a great responsibility in this connection. It is no longer good enough to leave the future of one of our most important renewable resources to the mercy of a Topsy-grown complex of administrative dogma. A searching review of our traditional attitudes towards the handling of this resource is overdue. Its objective should be the formulation of rational and consistent policies truly serving our avowed political and economic aims.

Forest policy, in its broad sense, includes the intent behind all actions having a direct effect on forests or forest lands, present or potential. It has not always been appreciated in the past that policies dealing land, taxes, trade and labor, all affect forest land and its use. The kind and extent of their effects should be taken into consideration in a review of a *forest* policy.

It will be noted that some of the outside influences which do, or at least should, impinge upon forest policy are under federal jurisdiction, some are under provincial control and still others are subjected to divided authority. It is therefore no wonder that there is in Canada no such thing as a national forest policy. In fact, official pronouncements of long-range forestry aims that contain enough objective reasoning to lift them above the category of platitudes are a rarety in this country.

In the main, provincial attitudes towards forestry and forest development are summed up in their accumulations of laws and regulations which are, in large measure at least, the result of hindsight. It is inevitable that piecemeal codes of this sort must contain conflicting elements designed as often as not to circumvent or correct specific malpractices. Not infre-

quently the cure is aimed at the symptom rather than at the cause, while at other times regulations are intended to support an ideal which, in itself, has little or no justification as a practical objective. Regulations concerning *waste* in woods operations could be cited as a case in point.

Under these circumstances it cannot be said that we have a forest policy or policies. *Policy* as we have come to think of it is simply the resultant of all applicable legislation, whereas true policy should be the consciously evolved political framework with which legislation is made to conform.

Objectives of Forest Policy

Government policies must be directed towards the greatest benefits for the greatest number of people. Governments then, are charged with the responsibility for maintaining and, if possible, improving the capital-resource position for future generations. Present *forest management* policies seem to reflect this viewpoint.

Governments are also charged with the responsibility for creating and fostering conditions for a thriving economy for the present generation. When applied to the forest economy, these responsibilities cannot be fully carried out by merely maintaining a *status quo*. They must widen their scope to include material encouragement to private owners, the healthy development of industries which harvest and market our forest products; and the research and experimentation without which our forest areas cannot be brought to their full capacity production are also prescribed. Unfortunately, present policies, other than forest management policies, are wanting in this respect.

Although most Canadian forest land is public property, it should be noted at this point that governments have responsibilities and authority unrelated to ownership. Their responsibilities regarding benefits for the general population may justify restraint of practices by private owners where policies of the latter conflict with the proper rights of the public. Their authority regarding fiscal, land and education policies, for example, should be exercised to protect, aid and stimulate the practices of private owners where their policies later contribute to the welfare of the populace.

Generally speaking, the objectives of provincial *forest management* policies across the country are admirable. There are variations between one province and another, but the similarities are more noticeable than the differences. The broad objective in every province can be stated in these words: "To provide for sustained-yield management on all Crown lands as rapidly as conditions permit while at the same time giving full consideration to multiple use".

Differences in forest policies between the provinces are found in the extension of the primary policy into specific areas, e.g., in protection, regeneration, research, and into private land management, education, and utilization. These differences stem chiefly from variations in local conditions or in stages of development.

Forest Policies in Relation to Stages of Development

A review of policies at different stages of development is not merely of historical and academic interest; it is also indispensable to the understanding of existing forest policies.

The first stage of development in Canada (and, for that matter, in any country with abundant forests and sparse population) is that of exploitation, with the government in the name of the people drawing its share of the profits in direct revenue. Policies at this stage are *protective*; they aim to set up *guards* against damage or loss of a source of revenue.

The second stage comes when consciousness of the renewable features of the forest awakens. Policies are *supervisory* and provide for *inspectors* to see that certain measures are taken to ensure renewal of the resource. In forestry circles, this might be called the extensive management stage. Policies are established for protection, sustained yield, and improved utilization. Associated with these policies is the thought that their implementation will mean satisfaction of the demand at present and for some time in the future.

The third stage comes when pressures develop which force more productive use of the resource to provide for the survival of the dependent industries. Policies must be *developmental*. The agencies for carrying them out might be termed *co-operators*. Policies are adopted for additional activities—silviculture, research and promotion. This is the intensive management stage.

These subdivisions are arbitrary, and the descriptions are oversimplified. However, regardless of where dividing lines are drawn between them, it is clear that at one stage the forest is already in existence; at another, man is aiding in its renewal; and at a third, man is forcing high productivity. Moreover, to obtain the greatest benefits with the smallest expenditures, the management policies should be of a protective and supervisory as well as of a developmental character.

Major Elements of Forest Policy Appropriate to the Present Stage of Development

A forest policy should set forth the aims with respect to both current and future operations. Of immediate concern are the acquisition of land for forestry purposes; the forestry purposes themselves, the establishment of the kind of forest to suit the purposes; the culture of the forest; the harvesting of the products; the processing of the products; and the sale of the products. To promote future benefits, policy must provide for economic studies of changes in needs for each of the purposes, and research into improvement of the growth capacity of the site.

The foregoing outline must then be extended into specific areas. Without by any means exhausting the list of items with which policies may be concerned, the following will indicate the wide range of subjects to be taken into account: land classification and use; protection from fire, insects and disease; inventories; access roads; regeneration and reforestation; research in silviculture, logging, markets and products; export of unprocessed wood; better utilization and development of forest industries; prevention of water pollution; aesthetic values; forest parks; watershed management; public education and extension service to private owners; wildlife and grazing management; professional and technical education; forest-land tenure; disposal and taxation.

Land Use Policies

A forest policy is part of and must be well integrated within an over-all land use policy. Strangely enough, though, this over-all approach has not enjoyed all the attention which it rightly deserves. From the premise that a sound forest policy is concerned with the best use of the forest land—potential forest land as well as land now in forests—emerges the need to determine which parcels of land are best suited to forestry.

The long growth period of the forest crop and the re-establishment of forest growth emphasize the need to find ways and means to resolve conflicts arising from the increasing demand for different uses of land. Only in recent years have land use policies tended to divert from their long-cherished goal of establishing as many settlers as possible on the land. This diversion, however, is far from being a complete turnabout. The legislation implementing our old-fashioned land settlement policies is still on statute books. The policies themselves, needless to say, have served many useful purposes.

But, we will long have to deplore the fact that, in many areas, our hurried land settlement programs, often carried on without prior study of the alternative and best uses of the land, have led to the complete removal of forest growth on lands that have since proved unsuitable to agriculture. Foresters are now grappling with the difficult task of reconverting those lands to their original and best use—their use as forest lands.

Land-disposal policies should provide for allocation for forest use. Consideration should be given to the ownership pattern of forest lands that will result in their most effective contribution. In countries where the wood harvest is approaching a non-expandable limit, the most intensive management is found on privately owned land. There are sufficient examples in Canada to indicate that private owners can do an effective job of sound forest management for sustained and increasing yield.

Land use commitments must be for an assured term so that an industry, to harvest and process the crop, may be established on an economically sound basis. In forest use, the guaranteed term must be a long one not only because of the heavy capital investment needed for pulp and paper mills and large sawmills, but also because of the delayed returns from forest management. Yet legislation often provides for only short-term leases, although practice condones long-term ones. Can it be said that there is a rational policy under such circumstances?

Regional Flexibility of Policy

Irrespective of the definition of the different stages of development, it is believed that all of them are to be found in practically all provinces simultaneously—which is not surprising. As an illustration, one may point out that just as a shortage of labor led to a wood shortage during World War II, high delivery costs may now lead to another wood shortage.

A sound over-all policy must therefore have a degree of flexibility that will provide safeguards against changes in certain aspects of the economic situation, and take account of regional variations in technical developments and forest resources, especially at the third stage of development.

As matters now stand, legislation is often so engrossed in the prevention of destructive exploitation and in sustaining royalty payments that intensive management may actually be inhibited.

Multiple Use

Benefits are derived from forest land when it is used for any of the following purposes:—

1. to supply raw material for industries (providing employment and revenue);

2. to protect soil and water (maintaining capacity for food production and water supply for many uses);
3. to support wildlife and provide recreation (fostering conditions favorable to physical and mental health, and supplying additional revenues); and
4. to provide pasturage for livestock.

All these uses are important, but, under varying circumstances, one of them will usually have higher priority. The forest can and should serve several or all of them simultaneously where benefits are to be derived from concurrent use. On an overwhelmingly large proportion of the forest land in Canada, however, the greatest benefits for the largest number of people will accrue from its role as a source of raw material for industry. Therefore, a sound forest policy should be directed towards improved supplies of wood for future industrial demand and the development of the wood-using industries with provision for protective and recreational functions as required.

Taxation and Other Levies Consistent with Objectives

Taxation, stumpage, and rental policies are areas where considerable study is needed to develop systems which will provide incentives for more productive use. The prevailing systems were not designed for present maximum-yield concepts. When these policies are reviewed, it must be kept in mind that the soil *not* the forest is the ultimate resource. As long as there is taxation of forest crops and assessments based on the value of timber as well as that of the land, sound forest management is discouraged. There is no severance tax on farm crops. This is not a matter of ability to pay, but rather one of developing a system that will reward high productive effort.

Stumpage dues were established as the people's share of a natural resource, into the growing of which the industrial user had put no money or effort. If stumpage dues are to be continued in the forest management era we are entering, the operator should be compensated for money and effort invested in the establishment and cultivation of the new crop.

Stumpages are normally flat rates applying to large areas over long periods of time. They have been reduced in times of depression and for less profitable timber, but such action is exceptional. Perhaps a better answer would be the reduction of stumpages to nominal amounts, or else their elimination and the substitution of another form of payment offering an incentive for high efficiency.

Private Lands

Earlier it was said that governments should have a policy respecting forests which they do not own. In extreme cases, where the policy of the owner conflicts with the welfare of the community, this might entail a forced change of the owner's policy or expropriation.

The authors of other background papers in this series have mentioned government control of cutting on privately owned forest land in some provinces. They have not suggested that this is a wrong concept, but they have observed that the controls as applied are either ineffectual or actually defeat their own purpose. Added to this it has been emphasized here and also by others that the systems of taxation of private forest land, with rare exceptions, are in sharp conflict with the avowed aims of restrictive legislation. Such a situation quite clearly demonstrates that a forest policy with respect to this class of land does not exist.

In many cases the forest owner is motivated by a desire for the successful conduct of a forest enterprise and this contributes to the welfare of the community. Corporate and individual forest operators, as well as so-called *hobby tree farmers* fall into this category. Here, sound government policy would be to provide such assistance as possible and to remove every unnecessary impediment to the successful conduct of the business. Generally the ordinary incentives to profit operate in these cases.

In still other instances the owner may be unaware of the potential of his forest land or else is preoccupied with another enterprise and becomes indifferent to the comparatively smaller values in his forest land. Most farmers who have woodlots, absentee owners and summer resort owners are in this category. Their policy, or lack of policy, is not necessarily detrimental to the general welfare. However, since communities benefit from increased productive activities of their inhabitants, an educational program is warranted.

It is generally conceded that the woodland sections of farms tend to have the poorest management of all our forest lands. There is little doubt that from national and provincial points of view there is in these properties a neglected resource. It would appear that here is a field where an aggressive policy of education and assistance by government could yield beneficial results to individuals, communities, provinces and the nation.

Competition and Marketing

A thriving economy is based on the production and sale of goods and services. In a forest economy, prosperity is largely dependent on world markets which are highly competitive. World competition brings into

play many factors besides the efficiency of current production as, for instance, the developed efficiency of years of experience as in Sweden (note that we are talking about the production of *forests)*, or the vast forest capital of a country like Russia. Strong national feeling such as led to the manufacture of newsprint in the southern United States is another element, while lower levels of living and the actual subsidization of industry in some producing countries place further obstacles in the way of Canadian manufacturers.

A capable policy-maker will keep an eye on the policies of his competitors, not necessarily to copy them, but to try to measure their desire to compete successfully.

Let us take a case in point. An excellent study and report has been made of the steps being taken by a major competitor, the southern United States, to produce more and better wood. Lussier and Maheux found that this competitor was seriously concerned with estimates of future demand (See: Lussier, Omer and Georges Maheux, *Forests of the Southern United States and their Influence on the Quebec Forest Industry,* Laval University, Quebec. 1959.) This study was sponsored by the Laval University Forest Research Foundation which is supported by forest industries. Government forest research agencies would be well advised to initiate similar studies of other competitive situations.

In this connection, let us look at our southern competitor. In 1980 the southern United States will have eight million acres of planted stock 20 or more years of age—some of it 50 years. These stands will be well stocked and evenly sized; they will lend themselves to mass production and mechanized logging and will be closer to the mills than the areas now being exploited. In other words, their logging costs will be lower in terms of today's rates than are today's costs. To remain competitive, Canada should plan, as far as possible, to organize for future wood deliveries on an appropriately similar basis. This is no mean task, but it would be most helpful to have a policy which would include studying where our wood is going to come from a few decades hence so that only the best operating chances will be exploited.

The Need for Review of Forest Policy

In the past 15 years, the forestry situation in Canada has been studied and reported on by Royal Commissions in seven of the ten provinces, and in the country as a whole. This is sufficient evidence to indicate widespread public interest in sound *forest management* policies. However, it is not sufficient to identify forest policy with sustained-yield management which does not automatically, and by itself, bring in its wake all the values that are obtainable from the forest. What has not been fully appreciated to date is that there must be sound *forest* policies with all that such policies imply.

Keeping in mind that a forest policy is made up of a large number of interrelated policies, it is desirable that present policies be reviewed to ensure that all component parts are appropriate for the current development stage.

In an orderly scheme of things, policies are set by owners. In Canada, then, forest policies should be established jointly and put into practice by provincial governments, farmers with woodlots, industrial corporations and individuals, other private owners, and the federal government. However, governments at all levels, although not the owners of certain forest lands, have special responsibilities for the derivation of benefits from the use of the land for the population as a whole. Therefore, to this extent and by reason of their ownership of the bulk of our forests, government must have an overriding voice in policy making.

Such a review is essential, not because the *objectives* of existing policies are poor, but because the policies have been arrived at piecemeal, frequently superimposed on general land- and fiscal-policies, with conflicting (or at best unrelated) objectives. The consequence of this Topsy-grown complex is ineffective implementation of some basically sound concepts.

A second good reason for such a review is that, in many cases, actual practice is ahead of or behind the expressed policy in accomplishing the objective of providing the greatest benefits to the greatest number of people. Policies ought to be set by owners and put into effect by administrators. But it is often the administrator who is taking the lead, and then there is a considerable danger that a change of administration may well mean a reversion to old policies and loss of benefits.

There is a basis of fairly solid forestry concepts common to the whole country, but as yet this is only a framework containing many weaknesses. This framework must be critically examined to ensure that each component member is sound and appropriate to the finished structure. It is also eminently desirable, especially where the owners are large groups or communities of people, that there be some formal statement of the policies affecting forests and forest land.

In the absence of a formal statement of over-all policy, owners, owners' representatives, and even administrators, must improvise on each occasion when

a situation arises which is new to them, thus adding to the piecemeal structure of independently fabricated components. In Canada today, the desirable treatments of forests and forest lands and the benefits to be derived from them are constantly changing and new situations are frequent. The policy maker and the policy administrator should have a comprehensive guide to develop sound policies in the several fields which affect the best use of the forest. The only agencies which can make recommended reviews and statements are forest owners or their representatives, namely, the provincial and federal governments, industrial forest-owners, and small woodlot owners.

To determine a sound and proper policy, it is necessary to know what the values are, measure the importance of each and then, by a series of comparisons and a process of selection, arrive at the highest priority value or combination of values. Not only economic considerations are involved but social, aesthetic, and spiritual ones as well. Furthermore, future values must be taken into account along with present benefits.

When a resource is abundant and population scarce, there are few problems because there is a surplus of values and the minimum of managerial and technical skill is required. Hence policies are simple.

When a resource or all resources are scarce and population is abundant the demand for values is greater than the supply; then the highest production of values must be attained, technical and managerial skill must be of the highest order and policies must be adopted for a complex of activities.

Canada is rapidly moving from the first situation toward the second. That is why the time is ripe for a searching look at our accumulation of forest legislation and forest practice to determine wherein it falls short of constituting a *forest* policy compatible with our present and future needs.

Section Six: Fisheries

93452—49

The Role of the Fisheries in the Canadian Economy

J.A. Crutchfield,
Professor,
Department of Economics,
University of Washington,
Seattle, Washington,

In the fisheries of Canada salt cod, canned salmon, and lobster carried much of the initial burden of regional economic development, and were literally the sole raison d'être for entire communities. Whatever their current problems, their place in Canadian history is secure.

Even in their halcyon days, however, the fisheries were no golden road to wealth and ease. Fishing was and is a hard life, by-passed in many respects by the social and technical developments that have eased the lot of most other workers. Nevertheless, the industry did provide export staples; and with them, vitally needed foreign exchange and a stimulus to income and employment in areas where remoteness and nature's niggardliness with respect to natural ressources would otherwise have precluded substantial growth, at least until much later.

The fisheries, though regionally significant on both coasts and in a few inland districts, will no longer play a leading and active role in Canadian economic development. But they are too important for us to ignore the difficult and continuous problems of adjustment which face them: problems which, in the main, are only partially self-correcting.

What unique characteristics of the fishing industry account for the chronic sickness and the constant need for government action? First, there is probably no industry in which both long and short-run relationships between effort and output are subject to so much uncertainty. Each fishery population is part of an incredibly complex environment. Even if all else remained constant, the dynamic relationships between fishing effort, population, and sustainable catch would be difficult to quantify. But all else simply cannot remain constant, and the painfully slow (and costly) effort so put together a scientific record of the key variables, hampered by our inability to see and count, have not progressed to the point where we can identify with precision the relationships so important to both industry and science. Moreover, the reaction time of a fishery population to, say, a change in fishing intensity may be so great that the full effects are not felt for many years.

A second aspect of the fisheries which gives them nearly a unique position in the Canadian economy is the common property status of the basic resource. Perhaps the word nearly should be emphasized, since this conference, concerned as it is with water, wildlife, and recreational use of the outdoors, will deal with most of the exceptions. However, the fishery case is certainly the most important instance of a head-on clash between the concept of a universal right of access to a resource and the requirements of sound economic utilization.

Other peculiarities of the fisheries are common to other resource-oriented industries in greater or smaller degree. One is the geographic isolation of the activity and the men who pursue it, and the consequent social and economic apartheid which, involuntarily, grows up around many of them. Fishing is, in real fact, a different way of life. If it is carried on in a physical environment ill-suited to other economic activity, the ability of its labor force to adjust to the inevitable changes in the market (or in the physical availability of fish) is seriously impaired.

A by-product of the necessity of fishing where the fish are is the distinct possibility of faulty operation of the waterfront market for fish. With vigorous competition among independent buyers and sellers we could be reasonably sure that the prices received by fishermen, while less stable than we might wish, would approximate their full economic value at the landing point. But this assumes actual or potential access by fishermen to a fairly large number of alternative buyers – at their own ports or at assembly points. Where landings are badly scattered, however, it may simply be impossible for more than one or two buyers to operate with any degree of efficiency. Fish processing

93452—49½

and marketing are not operations normally associated with economies of large scale. The actual buying areas are often so small that even firms of modest size become effective buying monopolists. *The consequences of such market structures continue to be of real concern in parts of Canada.*

Finally, it should be necessary only to mention the effects of the natural environment of fishing on the riskiness of business ventures. Fluctuations in the availability of fish, the vagaries of weather, and the inherent riskiness of relatively small craft in open water all combine to make control of supply and its adjustment to short-run variations in demand extremely difficult. If our view is extended to include the marketing operation, the extreme perishability of fish and the high cost of checking quality deterioration are additional impediments to orderly distribution. Again, these problems are similar to those of some agricultural industries and perhaps to forest products as well, but rarely in as extreme a degree. They are accentuated by the fact that more than 60 per cent of the Canadian catch is sold in export markets.

Any judgment about the extent to which the Canadian fisheries are making the best possible contribution to the regional and national economies involves the use of some guideposts among which the following are significant:

1) *Output.* At first glance it might appear that this can be specified in simple physical terms: the greater the production of marketable fish the better. But if the economy is at reasonably full employment, more fish can be produced only by giving up output of other useful things. As the limit of maximum sustained physical yield of any species is approached, the cost, in terms of other production foregone, becomes greater and greater for each addition to the catch. Internally, fishing effort (and catch) should be so distributed among different fisheries that an additional dollar's worth of labor and capital would yield about the same additional value of output in any of them. Externally, the same standard would apply to the choice between more fish or more of other things.

2) *Efficiency.* For each level of catch each fishery should operate at the lowest possible cost, given the techniques and knowledge available to the industry. In an important sense, the measure of an industry's contribution is its ability to use fewer inputs, not the number of jobs it can offer.

3) *Progressiveness.* Industries differ greatly in the scope they offer for progress through research and technological change. But each should at least provide incentives to develop new methods and products and to borrow, wherever possible, useful developments originating in other countries and other industries.

4) *Stability.* Optimum performance requires that fluctuations in employment, output, prices, and incomes be held to a practical minimum.

5) *Incomes.* Returns from fishing to participants should correspond approximately to their contributions to value output. Ideally, they should also be equal to returns (to both labor and capital) which could be earned in other occupations. A level of catch resting on exploitation of the inability of fishermen and vessel owners to move to better-paying areas or industries cannot be regarded as fully satisfactory.

It is obviously impossible within the limits of this paper to assess the Canadian fisheries fully against these standards. But it should be possible to indicate: (1) obvious and continued deviations from a proper economic position in the regions and the nation; and (2) inherent or institutional characteristics of the fisheries which are responsible for those conditions. Only then can we hope to explain the continued evidences of economic ill-health in the fisheries and to pin down the policies required to deal with them.

Fisheries in the National Economy.

The principal dimensions of the fisheries relative to the over-all economy of Canada are shown graphically in Figure 1 to 5. [1] With such marked regional differences among the Pacific, Inland and East Coast operations, these broad summaries must be treated with due caution. Nevertheless, some striking characteristics stand out clearly.

Even the most devoted fishery supporter must acknowledge that the industry makes a comparatively small contribution to national output and employment. Moreover, Figures 2 and 5 make it clear that there is a persistent downward trend in physical output and employment relative to national totals. In terms of *value* of output, however, the fisheries appear to have held their own remarkably well since 1935, as indicated in Figure 1. Price behavior has been mixed, with spectacular increases for some species and virtual

stagnation for others. Over-all, the prices to Canadian fishermen shot up very rapidly during the war and postwar inflationary periods, but have flattened perceptibly in the past eight years. Capital investments, particularly in fishing vessels, has continued through the 1950's at a surprisingly fast rate.(2)

How are these figures to be interpreted? Is the relative decline in output and employment evidence of bad economic performance or of proper adaptation to an altered economic environment? Why, in the face of these tendencies, do we find startlingly large increases in prices and capital investment in some areas – and why the wide differences among areas?

The failure of fishery production to keep pace with growth in the national product is largely a normal (and desirable) end result of factors on both the demand and the supply sides of the fisheries sector. One of the most stable relationships in economics is the decline in the proportion of food to total consumer good purchases with rising real incomes. Similarly, purchases of service components – processing, packaging, and ready availability – account for an increasing proportion of retail outlays when there are rises in levels of living. Since North American consumers generally regard fish as a somewhat inferior protein food, increasing per capita incomes typically lead to some shifting toward meat and poultry products. These generalizations, applying with little modification to both domestic and United States markets, suggest that in physical terms the fisheries should be expected to occupy a declining position in the economy.

The other *normal* aspect of the downward trend in the economic significance of the Canadian fisheries is the emergence of physical limitations on supply. This barrier to potential growth of output and employment in fisheries deserves special attention since it involves some slippery notions which can easily get out of hand. The central point is the definition of the term *supply*. At risk of being obvious to some and irrelevant to others, I should like, first, to stress that the *supply of fish* is an economic term, not a physical one. As an illustration of the point, look for a moment at the Pacific salmon. The maximum sustained yield which British Columbia rivers can provide might be defined, in purely physical terms, along the following lines. Assume that sufficient money is forthcoming for basic research in the biology of the salmon; for clearing of spawning areas and development of artificial propagation; and for improvement of catching techniques.(3) Assume further that all competing water uses which would cut back salmon production are eliminated (or, more reasonably, fixed at present levels). In these conditions it becomes possible to forecast a large increase in the potential supply of these valuable and regionally vital species, but only because supply has been defined as the maximum sustained catch which can be wrung out of a fish population without regard to costs.

What would such a forecast mean? Very little, if the purpose is to provide a guidance to industry and government. Even in physical terms, the inevitable growth of Canada's population, with the accompanying increase in required water services and the growing importance of industry make the second assumption meaningless. There will be different levels of maximum sustained yield of salmon for each possible combination of competing uses. If more power is needed, or more water for irrigation, or better flood control, fish production must suffer in some degree. But whether it *should* or not can be answered not by comparing physical outputs, but only by comparing values of alternative outputs and costs of the required inputs.

This brings us to the central point. The *supply of salmon* in the long run is a range of alternative outputs which can be obtained *at successively higher costs*. In the case of salmon there is little doubt that this relationship, shown graphically, would slope upward sharply. More salmon can be obtained, but only at very rapid increases in costs: directly, in terms of measures to improve natural spawning conditions and habitat and artificial reproduction; indirectly, in terms of other valuable economic products foregone if salmon output from multi-usage waters is to be increased. The ultimate limitation on the supply of any species is certainly physical, but it is equally certain that rising costs will chop off production before that limit is reached.

Viewed in this light, it is evident that the supply potential for Canadian fisheries is much more limited than a totting up of estimated maximum physical yields would suggest. A slight reinterpretation of the Gordon Commission report suggests that only cod, herring (particularly eastern), and mackerel, of the major species, could be taken in much larger quantities at relatively small increases in costs. Unfortunately, these are the very species for which long-term demand prospects are least promising.

To a considerable extent, then, the finding that the fisheries are a small and declining component of aggregate output and employment for Canada as a whole is to be expected, and implies nothing with respect to performance. Canadian geography and resource structure, compled with limitations on abundance of key species and the developing pattern of consumer de-

mand, require that the fisheries decline in relative importance as the economy expands.

This does *not* mean that the fisheries are unimportant; the health of the fishing industry in British Columbia, Newfoundland, and the Maritimes is a measure of the welfare of entire communities. Neither does it mean that the fisheries are a declining industry in the sense that they are, generally and inherently, guilty of bad economic performance. There are bright spots at present, and some of the darker ones turn out, on closer analysis, to result from imperfect policy measures or simply from failure of other related sectors of the economy to perform adequately. The very fact of this conference is evidence of common recognition of the unique difficulties which afflict those who exploit renewable resources and of the importance attached to them.

The following sections present a regional breakdown of the broad measures of production, employment, and prices, and analyses of the basic economic forces behind the evident trends.

Regional Fishery Development

A. *British Columbia.* The fisheries of British Columbia are dominated by salmon, herring and halibut operations. Only during the war years, with their attendant abnormalities, did these three account for less than 80 per cent of total landed value in the past 30 years, and recently their importance has loomed even larger.

Perhaps the most striking feature of these fisheries has been their economic strength. Like many other Canadian producers, the British Columbia fishermen have been hurt from time to time by foreign exchange problems and the general capriciousness of international trade after 1930, and they are subject to hardships imposed by wide and unpredictable variations in the availability of fish. But as fisheries go, they have been almost a show piece. Capital investment in boats and gear has risen steadily, and the pace of technological improvement has been good. While income data are scanty, they suggest that earnings have been at least moderately competitive with those in other occupations: a suggestion which is reinforced by the unusually high degree of mobility between fishing and other occupations.

The basic statistical record is shown graphically in Figures 6 to 10. Total marketed values of British Columbia fish have kept pace with Canadian national output (at current prices), and the number of vessels, particularly in the larger categories, has risen sharply during the postwar years. Employment has held fairly steady, and thus shows a declining trend relative to total employment (to be expected and desired in a fishery showing rapid technological progress). Figures 7 and 9, however provide a sobering note. It is apparent that physical production has lagged well behind growth in Canadian national output as a whole, and has been virtually constant over the past decade Practically all the increase in value has come from remarkable increases in the prices of both salmon and herring, and a more moderate upward trend for halibut. The reasons for this may be analyzed in terms of specific developments in each of the three major operations.

The story of the halibut catch is, of course, the story of a brilliant rehabilitation program. British Columbia not only shared in this revival but gained relative to American fishermen as the northward trend of the industry, hastened to some extent by the regulatory measures imposed, shifted a larger share of landings to Canadian fishermen and Canadian ports. Despite surprisingly weak price behavior since 1951, the halibut fishery has provided strong support to the regional industry throughout the past 25 years. However, the rate of increase in halibut landings since 1933 obviously cannot be sustained indefinitely. There is considerable evidence that both total output and the Canadian share may be approaching maximum sustainable levels.

Production prospects for salmon seem far less encouraging. The resurgence of the Fraser River reds (another tribute to international management in the face of great difficulties), is the only real bright spot. What *could* be done with substantial research funds, a free hand in propagation development, and iron control over dam builders is interesting but only partially relevant. In economic terms it seems likely that a combination of sharply rising costs of expanding the resource base, urgent demands of competing water usages, and the inevitable march of urbanization will become more and more restrictive. Past experience suggests, as a more realistic view, that a combination of good planning, good management, and good luck will be required to achieve even modest increases in production.

The herring fishery continues to dominate British Columbia tonnage figures, though its lower unit price is reflected in a much smaller relative contribution to catch value. There has been a continued shift toward concentration of herring utilization in oil and meal, largely as a result of very favorable prices. The output of canned, dry-salted, and bait herring has declined steadily from war and postwar levels. The future

is somewhat clouded, not only by the necessity of watching supply conditions carefully, but by the tremendous surge of world meal production, particularly in Peru, and the resulting prospect of continued pressure on all but the lowest cost producers.

Of the minor items only the luxury-level crab and the sole have shown continued strength, and production of both seems to have leveled in the past five years. The wartime peak in grayfish (shark) landings is unlikely to recur, with the development of synthetic vitamin oils, and the trend in ling cod and sablefish production has been steadily downward. Landings of gray cod could be expanded, but only if western markets for fillets and sticks strengthen substantially.

The picture of over-all stability of landings, with some shifting of composition, stands in sharp contrast to the startling increase in the value of the British Columbia catch. Only part of this is accounted for the general inflationary pressures. Though halibut prices have felt the competition of the booming frozen fillet trade, prices or both salmon and herring have far outstripped the wholesale price index during the war and postwar years. There is, of course, no mystery about this given continued increases in demand and the fact that additional output can be wrung out of a reluctant environment only at rapidly increasing costs. Limited supplies must be rationed by rising relative prices.

What of the cost side of the industry's performance? Ideally, we would prefer to see a leveling of inputs matching that in production, with some declining trend as technological improvements add to catching power, and some tendency to substitute capital for labor. Unfortunately, it is impossible to construct indices of inputs for the fisheries accurate enough to yield specific conclusions about the efficiency of labor and capital utilization. Employment data are blurred by the inevitable part-time and casual fishermen, and time series become unreliable as improvements are made in statistical coverage. Capital investment figures are, at best, rough estimates since no market test of the value of each boat and its gear can be made. The published totals include a mixture of valuations based on historical costs, current market prices, and replacement costs, and are thus particularly difficult to interpret after periods of general inflation or deflation. Changes in the total number of vessels conceal changes in both size and productivity.

Even with these qualifications in mind, examination of available data suggests conclusions which are, under any reasonable interpretation, disturbing. After a sharp drop during the early 1930's, the number of fishermen has changed very little for the past 28 years. However, the number of vessels hardly conforms to the ideal suggested above. Of the several categories recorded, only sail and rowboats have declined in number since 1933 (many were motorized, of course). The number of powered vessels increased steadily through the period, with the greatest relative growth in larger vessels which account for the bulk of the catch. Dollar values of capital investment in primary fishing (admittedly a poor measure of physical inputs during this inflationary period) grew even more rapidly: from $22 million in 1946 to $54 million in 1958.

It seems clear that the fisheries of British Columbia, far from releasing resources as catches of major species stabilized and efficiency improved, have absorbed significantly greater amounts. Some substitution of capital for labor has occurred, but the end result, stripped of details, is that it costs much more — in real as well as monetary terms — to catch about the same quantity of fish.

The reasons for this frustrating and potentially dangerous state of affairs in the West Coast fisheries have been thoroughly explored in recent years. Canadian economists H.S. Gordon and A.D. Scott have been major contributors. In essence, the absence of property rights in the sea fisheries (and in many fresh water operations as well) leads inevitably to overfishing, unless government intervenes. Government intervention has taken a number of forms. Quotas on catches of halibut and herring, area and seasonal closures and gear restrictions in the salmon fishery, and a general tendency to curb introduction of more efficient gear have been the chief regulatory devices. In no case, however, have these measures been accompanied by effective power to restrict the number of fishing units. Though the primary danger to the fishery resource is thus held in check, the effects on prices of secular increases in demand and of improved technology lead inexorably to an increase in resources use for fishing. In such a situation, the temptation to violate the regulations becomes stronger and more rigorous policing is required to maintain proper order.

In the processing sector, where the common property problem does not exist, the number of plants and of workers employed has declined steadily as competitive pressure forced firms to more efficient methods and scales of operation. The number of salmon canneries, which ranged from 60 to 75 during the 1920's and early 1930's, had dropped to 18 by 1956.

This analysis of developments in the British Columbia fisheries assumes implicitly that other occupati-

ons are in fact available to absorb labor and capital released by the fisheries. Only then could it be argued that technological advances in a physically stabilized fishery should lead to a steady reduction in employment of men and equipment. The Canadian west has maintained relatively high growth rates in recent decades, and while there remain *pockets* of immobile fishermen (particularly among the Indian population), alternative jobs have been widely available.

We would therefore expect to find no startling discrepancies between money incomes of fishermen and of other workers in the region. Entry and exit are not impeded (except for the Indian) by severe cultural or economic barriers, and the generally buoyant economic environment of the postwar years provides both the means and the incentive to equalize labor returns in a rough way. The relatively high concentration of processing and marketing in large firms in British Columbia also suggests that necessary adjustment of the amounts, types, and location of capital would not present insuperable problems.

Unfortunately, these hypotheses cannot be tested adequately from existing data. Natural factors, combined in some cases with the effects of catch regulation, make British Columbia fishing a highly seasonal occupation. A really satisfactory analysis of the level of money incomes cannot be undertaken from returns to one fishery alone, or even from all fishing activities, since shore jobs and government transfer payments are necessary supplements for a great many fishermen. Studies covering all sources of income are too expensive to run on a continuing basis, quite apart from the increasing resistance on the part of those under survey. The recent Buchanan-Campbell analysis of incomes to British Columbia salmon fisherman does provide thorough coverage for the years 1953-1954, and their findings suggest that average total incomes were comparable to those of other occupations during the period surveyed. However, the dispersions around the averages and the yearly variations are very large, reflecting the unusually wide (and still virtually unpredictable) variations in runs of individual races of salmon.

It would appear that the level of income *to the individual unit* in British Columbia would not be a matter of great concern to government if the regional economy were growing at a pace sufficient to provide good job-alternatives. However, this requires two important qualifications. First, even though the men may be relatively mobile, the capital equipment is not, at least in response to a drop in income. A persistent tendency to hang on rather than to abandon the boat and gear (bolstered by the perennial hope of the *big year)* can cause equally persistent hardship for large groups of British Columbia fishermen even when other industries have jobs to fill. When prices are under pressure, because of demand conditions or the inroads of overseas competitors, even this relatively healthy sector of the Canadian fisheries finds adjustment a slow and painful process. A fishing vessel takes an unconscionably long time to depreciate, and British Columbia does not offer much in the way of alternative uses.

Secondly, and much more important, the money incomes of individual fishermen tell us little of the efficiency with which productive factors are being used in the industry as a whole. The Pacific Coast salmon and halibut fisheries are classic cases of excessive entry in response to relatively favorable prices, the end result of which is to tie up more than the required inputs with no self-correcting tendency. Good incomes to fishermen and a relatively modern, efficient group of vessels are certainly desirable, but they are not necessarily evidence of economic efficiency for the industry as a whole.

In summary, the place of the fisheries in British Columbia's economy is not simple to define. In terms of total value added the industry has held its position among primary producers in the region. Yet its real output has barely been maintained, offers no great possibility for long-run growth, and has absorbed more rather than less productive effort in the past 20 years. The prime concern for the future must be to expand modestly the output of British Columbia's high-valued catch with fewer men and fewer and progressively more effective fishing units.

B. *The Maritimes, Quebec and Newfoundland.* The fisheries of the East Coast differ markedly from those of British Columbia. The broad continental shelf of the Atlantic Coast dictates a much higher concentration on ground fish, and a corresponding emphasis on trawling, long-lining and trapping. Market characteristics are equally important. With the notable exception of the lobster, the Atlantic Coast catch is dominated by species of rather low unit value, much of it sold in competitive international markets. The costs imposed by wide dispersion of fishing activity and seasonality are particularly burdensome for that reason.

Summary data which provide a general view of the Atlantic fisheries are presented in Figures 11 to 14. Total production in the Maritimes and Quebec shows a perceptible upward drift, particularly in Nova Scotia, though it has not kept pace with the growth in national product. Newfoundland, on the other hand, has been hard-pressed even to maintain its total catch, and has

fallen much farther behind in total value because of its heavy reliance on the salt cod markets.

As in British Columbia, fishing accounts for a steadily dwindling proportion of the total labor force. This is particularly marked in Quebec, where good employment opportunities developed in close proximity to fishing areas, but it is evident throughout the Maritimes and Newfoundland as well. The small but persistent growth in landings has been achieved by a marked shift – partly from within the industry and partly as a result of government aid and guidance – toward expansion modernization of capital equipment. The Atlantic Coast fisheries, long ridden by inertia born of tradition, inter-area rivalries, and the deadening effect of prolonged poverty, had much ground to make up in this respect. The thrust of wartime demands, striking technological developments in processing and marketing frozen fish, and the selective use of government assistance is evident in greater catches and in a marked growth in the number of modern, versatile vessels.

The behavior of prices to fishermen reflects the dual impact of the war and a subsequent acceleration of structural changes in both demand and supply. The urgent need for fish during World War II, together with problems of effective price control, caused a tremendous jump in prices from 1939 to 1946. Thereafter, prices have drifted upward very slightly, primarily because of shifts toward higher-valued and products to meet the burgeoning demand for frozen fillets and blocks. Price strength in lobsters (because of natural supply limitations) and haddock (a major item for the developing dragger fleet) was only partially offset by relatively weak prices for herring and cod.

Behind the now familiar pattern sketched in these broad terms lies a series of very substantial internal changes in the structure of the Atlantic Coast fisheries to which the industry has not fully adjusted. Though really adequate statistical evidence is lacking, there can be no doubt that incomes to fishermen are below those in other occupations. The fact that chronic poverty now occurs more in pockets than over whole provinces makes it no less galling to those who must endure it even in the face of general prosperity in the nation. In a technical sense neither the fisheries nor the processing and marketing operations are at levels consistent with existing knowledge.

The heart of the economic troubles besetting East Coast fishermen lies in the matter of mobility. The inevitable tides of change – in demand and in technical conditions of production – require shifting of resources, human and physical, in a healthy market economy. As a corollary, they frequently require different kinds of resource combinations, most frequently in the direction of substitution of capital for labor. In the case at hand, social and economic factors have compounded the difficulties of achieving both of these ends. In the past, and even today, the influence of static traditional attitudes has impeded both the introduction of better techniques and the willingness to seek other employment. In addition, the meager natural resources of many of the areas affected simply do not provide any good alternatives except to move out. Quite apart from the resistance of individual families to change, the pressing economic conditions which made it essential have often resulted in prices and incomes so low as to make it financially impossible. The incentive to break with the parts is usually greatest at precisely the times when the ability to find alternative jobs and to finance the move are lowest. The necessary outflow of excess labor from the East Coast fisheries has been greatest when relative prices of fish were quite favorable.

These barriers to reduction of excess labor in declining sectors of the fisheries tend to reinforce resistance to equally necessary improvements in technology. With abundant supplies of underemployed labor, it is not necessarily bad sense to use it in small and fragmented processing and marketing operations. This may not be efficient in an engineering sense, or even in an economic sense, over the long run; but it *is* a perfectly logical short-run reaction. Similarly, there will inevitably be great resistance to the introduction of larger scale, capital-intensive fishing methods as long as labor is readily available at wages well below the *opportunity level* in other sectors of the economy. It need hardly be added that political pressure to restrict new types of gear, particularly if they are labor-saving, can be mobilized much more effectively in a situation of chronic underemployment. The effects of this are still very clear in the structure of the Atlantic Coast fleets.

The data suggest that the postwar period, characterized by high growth rates in the Canadian economy, and the development of strong markets for frozen fillets and sticks in both Canada and the United States, brought real progress in the struggle to restore some semblance of economic health to the fishing communities of the Maritimes and Quebec and to parts of Newfoundland. There are, however, some inherent limitations to continued progress along these lines, and they appear substantial enough to raise serious doubt that the entire East Coast fisheries can resolve their basic problems through operation of the market mechanism alone.

On the supply side, the fisheries of Newfoundland and, to a smaller extent, of the Maritimes, must deal with troublesome problems of distance, dispersion, and climate. As in so many parts of the world, fish and the people who eat them are much too far apart for convenience, and it is difficult to fish for more than a fraction of each year. The costs of assembly, processing, and marketing of end-products bear much more heavily on a industry based on low-valued species. Since fishing vessels are notably inefficient carriers, dispersion of fishing activity raises further problems of full utilization of modern processing techniques, which require fairly large and continuous supplies of fish. Newfoundland and some of the outports of the Maritimes have therefore enjoyed only a fraction of the new demand to compensate for the steady decline of the salt cod trade.

Changes in the pattern of demand in recent decades raise further complications since they do not well mirror the resource base of Canada's eastern waters. Supplies of cod, herring and mackerel are definitely expansible in the economic sense developed earlier. Large increases in output could be realized without costly *new* technological changes or any major cost-increasing effects on abundance. But long-run demand prospects for these species are anything but bright, particularly in traditional processed forms. Demand for Canadian salt cod may well become relatively insensitive to income growth in its familiar low-income markets. Variety will be an increasingly important element in protein demands as these nations press on to higher living standards, and increased ability to pay may well be offset by the desire for more diversification in protein foods, even at higher prices.

Moreover, because dried fish is still a vitally important source of cheap protein, it is becoming a focal point for fishery development work in these same countries. Africa, and South America, in particular, are looking to their stocks of low-priced demersals to relieve exchange problems and perhaps to build export surpluses of their own. Even where this does not affect Canadian markets directly, it may displace production from other areas and contribute further to price weakness – the more so if some new entrants to the field are comparatively unstable *holders* of dried fish stocks.

To part of the East Coast fishery, the generally unfavorable price picture in salt cod and herring has been offset by the welcome expansion of the American market for frozen groundfish fillets and blocks (and, to some extent, for particular styles of salt cod). Again, however, the clearly defined resistance to increased per capita fish consumption in the United States sets definite limits. Once the *new* market for fish in the convenient and semidurable frozen packages has been worked out, demand is not likely to increase at a pace much greater than population growth. And it will have to be shared with other North Atlantic nations as well as with American producers.

It is obviously most unfortunate that this market shows a distinct preference for groundfish other than cod, and thus focuses Canadian effort on stocks which are much less extensive and on producing areas other than the ones hardest hit by the long decline in the salt fish trade. What is really needed is a process to make cod taste like salmon, or a species of lobster which reproduces like herring. Failing this, the unfortunate combination of declining demand for abundant fish and supply limitations on those in consumer favor will leave spots in the Atlantic fisheries which tend to become self-perpetuating.

It should be emphasized that these problems are not peculiar to Canada or to the fisheries. Norway, Iceland, the United States, Scotland – to mention only a few – have struggled even through the prosperous postwar years with chronic depression in areas dependent on resource industries. Indeed, it would be hard to name a major developed nation in which the problem of immobility, compounded by and reinforcing technological backwardness, is not of constant concern in agriculture as well as in fisheries.

In brief, the Atlantic Coast fisheries have come a long way from the catastrophic depths of the thirties, but the development has been uneven geographically, and it has been sparked by forces which are now subsiding to a more modest long-term pace. The process of technical updating assumes a market for expanded production, sources of the right kinds of fish, and a national economy able to siphon off the surplus labor generated by modernization. Again, the problem is one of excessive use of inputs, but for reasons quite different than in the British Columbia salmon and halibut operations. (4) Perhaps most important, it is only partly a result of inherent weaknesses in the organization of the fishery. Equal responsibility would have to be assigned to the complex forces which have inhibited growth and diversification of the regional economy. It follows, then, that vigorous growth in the national economy is a prime requisite for any broad correction of the position of the Atlantic Coast fisheries in the economy. Without decrying the urgent necessity of using market forces to press toward a more efficient and progressive industry and better incomes, the problems

appear too broadly based to rely on this mechanism alone.

C. *The Freshwater Fisheries.* Space limitations make it impossible to give full attention to developments in Canada's inland fisheries. This neglect may perhaps be excused on three grounds: they are smaller in total than the sea fisheries; they are less significant in their respective regional economies; and they will probably decline even more in relative importance over time.

As indicated in Figures 15 and 16, the index of freshwater landings was not affected as drastically by the war as those for the sea fisheries, but it has shown a mild upward trend since 1947. Again, however, it falls short of the growth in general economic output. Prices of fresh water species show the typically sharp wartime increase, but have been relatively weak in the postwar period. Numbers of fishermen have declined steadily in recent years, while capital investment has expanded but at a somewhat slower pace than in the sea fisheries.

These aggregates cover such a wide variety of situations, however, that the full story of recent growth and change in the inland operations is thoroughly concealed. For example, the weakness in prices paid to fishermen, despite higher market prices, is due in part to the expansion of the fishery to more remote areas, such as in the Northwest Territories and the northern Prairie Provinces, with a consequent increase in transportation and marketing costs. Similarly, the growth in over-all output masks a continuing substitution of lower-value (and more distant) fish for catches of more desirable species in waters closer to markets.

Perhaps more important is the virtual impossibility of treating the Canadian operation apart from the American Great Lakes fishery. Both are geared largely to a specialized market centered in Chicago and New York, and both exploit the same species. To some extent the incentive to expand the Canadian catch of lower-priced fish and to push farther afield even at considerable extra cost stems from supply limitations on major species in the principal lakes shared by the two countries

There is little to suggest the prospect of long-term growth in these fisheries. However, two important avenues of potential economic gain are available. One is the hope of reviving the lake trout and whitefish populations as the Great Lakes Fishery Commission research programs reach fruition. If the disastrous blows inflicted on these stocks by the sea lamprey can be even partially offset, an increase in production of the right kind in the right places could be realized. The other is to improve the organization of the entire production-marketing flow. In terms of techniques, financing, and effective competition in marketing, these fisheries have lagged as badly as any in Canada. This is not to assign blame, however; in large measure the structural problems of the lake fisheries are a product of weather, distance, narrow markets, and dispersion of production. Nevertheless, even when one distinguishes carefully between *expensive* and *inefficient* operations, there is reason to hope that the net economic yield from the inland water fishery can be increased even after natural limitations have choked off further expansion of output.

The Role of Government

The details of government efforts to improve performance of the fishing industry will be found in other papers prepared by experts in the various fields. However, no discussion of the role of the fisheries in the Canadian economy would be complete without brief reference to the types of government intervention and their economic implications.

In virtually all major fishing nations it has become a recognized responsibility of government to provide basic research, development, and statistical services for the fisheries. As in the case of agriculture, the small scale of most business units, tight profit margins, and a certain degree of social separation militate against *internal* progressiveness. There is neither the incentive nor the means, in most cases, to keep pace technically with other industries in which larger and financially stronger units develop naturally out of their physical and economic environment. These services, essentially complementary to private enterprise, have contributed tremendously to the growth of the fishing industry. They might well be regarded as legitimate social costs which can be minimized by public administration. In this sense Canadian government programs will bear comparison with any. As the report of the Royal Commission on Price Spreads points out, there are real deficiencies in the statistical record of the fishing industry, ([5]) but the cost of correcting them is probably greater than any benefits which would result.

In the remainder of this section I should like to consider other aspects of government participation: direct financial and technical aid; regulation; and valuation of the fisheries in areas involving competing uses of natural environment.

The bulk of the aid to the fisheries has gone to the chronically depressed sectors of the Atlantic Coast operation. The dollar amounts for direct aid involved have not been large, but a complete accounting would be much more impressive. If, for example, expendi-

tures on harbors, port facilities and navigation aids could be allocated to end users, the fisheries would doubtless be among the largest beneficiaries. Similarly, some community service expenditures and extension services are directly or indirectly attributable to conditions in hard pressed fishing areas, and unemployment compensation payments there have been substantial.

There is a tenuous line here between short-run and long-run objectives, and a certain inevitable degree of inconsistency. The income situation of many fishermen in scattered outports has demanded government intervention in the interest of humanity and economic equity. Yet the hard fact remains that permanent resolution of these situations must strike at more fundamental causes: lagging economic development locally, compounded by economic and cultural barriers to mobility; and the self-perpetuating impact of poverty in technological progress. Relief of the symptons of an over-supply of labor presents a certain risk of weakening incentives (and political pressure) to rectify the causes. On the other hand, if the principal obstacles to both rationalization of techniques and the desired outflow of labor is the deadening effect of low incomes, even direct supplements to incomes may work in the right direction. The American experience in coal mining and some segments of agriculture is a case in point.

Postwar Canadian policy appears quite defensible in this light. The most urgent humanitarian problems created by localized weakness in the fishing industry have been met through unemployment compensation and other direct aids. At the same time, the technical assistance (e.g., low-interest loans and vessel subsidies), on both federal and provincial levels has been tied to a parallel research and education program to stimulate better fishing and processing methods and the development of more valuable and products. Again, however, caution is indicated. A modernization program designed to shift the Atlantic fleet toward larger vessels, with greater sweep efficiency and versatility, means an increase in output at lower average costs. Of itself, this will put even greater price and income pressure on the large number of small-boat fishermen who cling, through ignorance of inertia, to their traditional ways. Unless there is some directly offsetting decrease in catch, preferably through reduction in labor inputs and in output of less desired species, the full benefit of a research and subsidy program to make the fisheries more competitive will not be realized.

Some consideration must also be given the competitive structure of the markets facing fishermen as purchasers of vessels and supplies, and as sellers of fresh and semi-processed products. The geographic dispersion of much of the East Coast fishery and its essentially small-scale character raise the possibility that salt and vessel subsidies may show up as additional income to shipyards and wholesalers rather than to fishermen. Indeed, the unusually high degree of integration and concentration among fish processors and marketers raises a whole series of knotty problems. There is ample evidence of non-competitive behavior among buyers in all three regional fisheries, but it is not at all clear how this can be rectified without creating even more troublesome problems. A partial answer has been sought in the encouragement given cooperatives. In the long run, however, it seems likely that some application of anti-monopoly legislation appropriate to the peculiar structure of the fisheries will have to be worked out.

The war and postwar years have demonstrated dramatically the importance to the fisheries of strong over-all performance of the economy. The East Coast, in particular, still faces a long, difficult process of adjustment before it can be said with assurance that no further gains could be realized by relocation of underemployed labor and better adaptation to the current demands of a changing market. This may, however, involve a real dilemma for the fisheries, if experience confirms fears that small but persistent price increases are a necessary cost of sustained high level employment in Canada and the United States. On the one hand, the necessary reduction of trapped labor and modernization of fishing and processing techniques call for strong markets. On the other, the price effects of forced draft employment and growth policies will add further pressure on to the already precarious competitive position of Canadian fish in markets outside North America. It is by no means established that satisfactory employment and growth rates are incompatible with reasonable price stability for the economy as a whole. But if some of Canada's fishery products are now competitive only on the basis of subeconomic returns to fishermen, correction of the income problem requires simultaneous increases in overall efficiency if further market losses are to be avoided.

The story of Canadian accomplishments and problems in the regulation of fishing activity is covered in Mr. Ozere's comprehensive paper. It will suffice to note that the necessity for regulation arises out of the common property status of virtually all marine and some fresh waters, and to point out some of its economic implications.

The most significant has already been referred to in the discussion of British Columbia's fisheries. In the absence of regulation, both salmon and halibut might well have been driven to extinction – economic if not biological. Any economist or business man must shudder at the thought of devoting more and more effort to the capture of fewer and fewer fish: a situation which is nearly inevitable when limited stocks of high-valued fish are involved. It can hardly be contested that both the industry and the nation have benefited from controls over fishing mortality in these and other Canadian operations.

However, it can be argued that neither objectives nor techniques of regulation indicate that the regulators have yet absorbed the really crucial point. Regulation amounts to a stewardship of the resource, to be used to assure wise management in its use. If so, then surely it is proper to ask the regulatory authority to include as a prime objective the maximization of economic benefits from the resource, as would be expected of any other sensible landlord. This takes us back to the standards of industry performance listed earlier, and raises a further question: can regulatory authority fold its hands once it has set and enforced the *right* catch level? From the viewpoint of the fish stock, it makes little difference how the necessary curtailment of catch is brought about, but from that of industry performance it is equally important to insist that it be done in the most economical way. Specifically, it should encourage use of the most efficient gear and vessels, and it should stimulate rather than stifle invention and innovation leading to further lowering of costs.

Effective reduction of fishing mortality must relate to one or more of four factors: the number of units; their catching power; total fishing time; and area tribution of effort. With a few exceptions, which can be put aside at this point, the last three could be lumped under the heading of efficiency reduction. In some cases (e.g., the outlawing of salmon traps or banning of trawl gear) this is the avowed intent of regulation. In others (e.g., quotas on halibut catches) efficiency effects creep into both fishing and marketing as the industry reacts to the regulations and to the rebuilding of the stocks.

The remaining alternative looks far more attractive. If ways could be devised to curtail fishing intensity to desired levels by limiting the *number* of units, each operating at maximum efficiency, we could accomplish all that can be done with the existing paraphernalia, and we could realize significant savings in underutilized fishermen, vessels, and gear, and overutilized enforcement officers. This is obviously a counsel of perfection. In practice such techniques as area closures, seasonal closures, some gear restrictions, etc., must be used if only to provide needed flexibility.

But until restriction of numbers is accepted as the basic tool of regulation, we may expect the British Columbia situation to spread and to become more pronounced. Successful rebuilding of stocks reduces fishing costs and attracts new investment. Improved gear does the same. Secular increases in demand raise prices, and still more inputs can be accommodated. In terms of my topic, the regulated fisheries of Canada are too large in one critical dimension: efficiency. The very success of the programs serves to trap unnecessarily large amounts of labor and capital and to impose a variety of additional costs on processors and marketers. It is well to remember that fish are not the only resources to be conserved.

Let me hasten to add that this is no indictment of Canadian regulatory measures. They have, on balance, been considerably more successful than most. Nevertheless, there is no room for complacency if it can be demonstrated that the fisheries are not adjusting toward an optimal position in the economy, regardless of increases (or the prevention of decreases) in physical yields. Healthy fish stocks are a necessary but not a sufficient condition for a healthy fishing industry.

Another aspect of government policy bearing on the role of the fisheries in the Canadian economy has been pointed up in two controversial areas which threaten to plague us for years to come. Both involve problems of resource valuation; both require specific decisions by government; and rational solutions in both are impeded by institutional peculiarities of the fisheries.

The first concerns the place of fisheries in multipurpose water development programs. At stake are segments of Canada's most valuable fisheries – the Pacific salmon populations of the Fraser, Skeena, and some smaller river systems. Unfortunately, they are found in an area in which sustained economic growth is generating increasingly urgent demands on the river systems for power, irrigation, flood control and household and industrial use. To some extent the fresh water fisheries face the same difficulties, though not in the same degree. It would appear that Canada, with the unpromising record of salmon usage in the states of Alaska, Washington and Oregon before it, might do much better in reaching an optimal economic apportionment among the complex competing and complementary demands for water.

This is not to say that fish are good and power bad. Much of the difficulty in reaching sensible solutions in the American cases has arisen from the tendency of one side to paint the issues in terms of forward-thinking conservationists against greedy profiteers, while the other rails against impractical emotionalism as an obstacle to sober and progressive business development. It would be equally disturbing to find the preservation and restoration of fish runs given either more or less than their proper importance. There is little evidence that *fish vs. dams* controversies have yet given us a sound basis for judgment.

The so-called *cost-benefit* basis for evaluation of multiple-purpose river development schemes is now widely accepted. It provides a generally acceptable technique for comparing present values of anticipated revenues and costs, though the choice of discount rates, assumptions about price changes over time, and other elements of application are subject to debate. One would expect that the impact of water development schemes on fisheries, as well as on other water users, could be evaluated within this framework. In fact, however, a rigid application of the technique invariably points to a net economic yield from the fisheries which is zero, or even negative. This apparently anomalous result (after all, everyone *knows* that salmon are valuable) usually leads to an uneasy presentation of gross income estimates, employment data, and an appeal to the esthetic values of nature. As far as the American experience is concerned, there is a lurking suspicion that the fisheries may have been accorded much less than their due because of the inability of their advocates to present their case in conventional terms of net money yields.

The crux of the matter can be developed readily from the Gordon-Scott analysis of the economics of common-property resources. As long as entry to a fishery is free, no net economic yield can persist since it would attract new units until average total costs, including the essential return to capital, are again equal to price. In practice, the initial surge of entrants into a new fishery, coupled with the long life of properly maintained fishing vessels, will often result in a prolonged period of distinctly subnormal profits. It is hardly surprising that this approach to valuation of a fishery resource rarely sees the light of day.

Yet clearly the comparison of net economic yields can and must be made if fish and power are not completely compatible and choices must be made. What is needed is one additional and crucial bit of information: what net economic yield could the fishery produce if it were managed *with that objective in mind?* This could be viewed from the standpoint of a franchised private firm or of a government department leasing or selling fishing rights on its own account. To make sensible comparisons we need the discounted values of the future net yields which could be produced, not those which actually result from operation under a system which precludes any rational incentive to *conserve* the fishery resource. Certainly the estimates of net yields from power, irrigation, etc., are predicated on control of inputs, reasonably good management, and use of the most efficient techniques available. It is hard to believe that an experienced salmon packer, granted exclusive rights to the Fraser River runs, would not show a far greater *net* yield than can be anticipated under present conditions.

I suspect that the case for preservation of salmon runs, wholly or in part, might be much stronger if this approach were used as a basis for estimates of the economic cost of river development *projects*. True, it is not likely that it would settle all fish-power controversies in favor of fish; nor should it. But the construction, location, or timing of some dams and the justifiable expenditures for fish ladders, hatcheries, and other devices required for fish propagation might well be affected critically. At the very least, we would have the satisfaction of knowing that all competing water uses had been considered consistently in arriving at decisions which literally determine their future positions in the regional economy.

The concept of net economic yield is equally applicable to the assessment of sport fishing and its proper place in the pattern of resource usage in Canada. There is a certain reluctance in most English-speaking countries to view a recreational activity fraught with such hallowed tradition in anything but subjective (and emotional) terms. Yet there is no particular reason why the amount which people would be willing to pay for fishing (not the catch itself, but the activity) should be any less adequate as a measure of value than the price paid for theatre tickets or symphony concerts. The problem is to derive an estimate of net yield. It will do no good, in weighing sport fishing against commercial fishing or alternative water uses, to determine, at considerable cost, what the average angler spends on his sport. If he were not fishing, most if not all of this would go for other expenditures, and would provide other kinds of jobs and incomes. What is needed is an estimate of what anglers collectively would have been willing to pay (over an above the cost of rods, reels, bait and other direct outlays) for the right to fish. This is the *net* economic yield which

would be lost if opportunities for sport fishing disappeared.

To some extent this can be measured directly: for example, from the prices realized for fishing rights on Atlantic salmon waters. However, the great bulk of Canadian sport fishing requires only a nominal license fee, usually aimed at covering some, at least, of the operating expenses of the government agency which manages the fishery. I have no quarrel with the decision to ration scarce and valuable rights by some means other than price (i.e., seasonal closures, area closures, and catch limits). But there is a compelling need to recognize that the rights are no less valuable because the government chooses to give them away. Sport fishing, particularly in a country as well endowed with game fish as Canada, has become much too important to ignore in assigning appropriate levels of water (and land) usage. There is a real danger that unwillingness or inability to develop and use estimates of net economic yields from sport fishing will result in significant understatement of its real importance. Indeed, the concept might usefully be extended as a technique for evaluation of wildlife and wilderness recreational areas in general.

Conclusion. The purpose of this paper is to present issues; time and wiser heads must provide the answers and the ways of translating them into appropriate policy. However, if one offers criticism, he bears an obligation to set forth useful conclusions in terms of the standards of performance by which he has measured.

With respect to proper allocation of productive factors, the performance of the fisheries has been disappointing. There are definitely too many men and too many units of gear by a straightforward test: the same resources used elsewhere would produce other things of greater value. It should be stressed again, however, that while this situation is general, the reasons for it are very different in the Atlantic Coast and inland regions on the one hand and British Columbia on the other. The latter involves essentially a dissipation of economic rent through excessive use of both labor and capital, with at least a possibility of reasonably competitive earnings to individual fishermen and vessel owners. To the extent that output of the major species is very close to maximum sustained yields, further increases in demand (or improvements in fishing efficiency) will make the problem worse, not better.

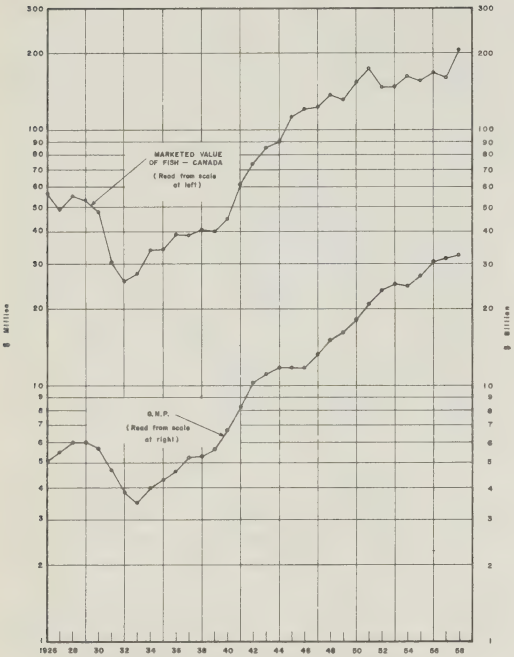
On the Atlantic Coast the excess of inputs is due primarily to sectional weaknesses in demand, coupled with poor opportunities for shifting occupations and a general disinclination to change. The latter may be regarded as a sort of feedback effect, running from low income to inefficient production to occupational immobility and back to low income. Suppliers of all major products except lobster are much less tightly confined by natural limitations than in British Columbia. Here the effects of rising demand would clearly be beneficial, but only if directed primarily at the species for which supply conditions are most favorable. Equally important is the need for simultaneous *pulling* of excess labor through regional and national economic growth and *pushing* through a directed program of modernization and expansion of efficient capital equipment. These are large burdens for the market mechanism to shoulder alone, particularly in the face of continued declines (at least in relative terms) for some of the most important end products

It follows from this that efficiency and progressiveness in the industry leave much to be desired. The British Columbia fisheries are fairly well advanced as far as efficiency in the engineering sense is concerned, but there are far too many of them working well below full capacity. On the Atlantic Coast low incomes have reinforced other obstacles to mechanization and modernization, not the least of which has been the lingering effects of past restrictions on gear. The necessity of regulating fishing effort has brought with it a variety of techniques for reducing catches, virtually all of which increase the cost of any given level of output.

The very nature of fishing rules out the degree of stability in employment, prices, and incomes, which many other occupations enjoy. Whether this is, on balance, more an attraction to the venturesome than a deterrent to those who value security cannot be readily answered. What is needed is an environment in which the *level* of incomes is sufficiently attractive to make the choice an economically feasible one to a labor force able to move elsewhere if necessary.

— FIGURE 1 —

MARKETED VALUE OF FISH PRODUCTION, CANADA 1926-58 AND
G.N.P. CANADA 1926-1958



Source: National Accounts, 1926-58, D.B.S.; and Dept. of Fisheries Data.

— FIGURE 2 —

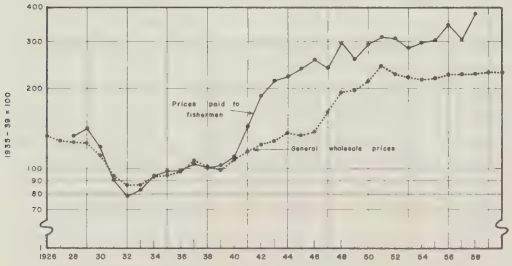
CANADA, INDEX OF FISH PRODUCTION AND
CANADA, GROSS NATIONAL PRODUCT (in 1949 dollars)



Source: National Accounts, 1926–1958, DBS; and Department of Fisheries data.

— FIGURE 3 —

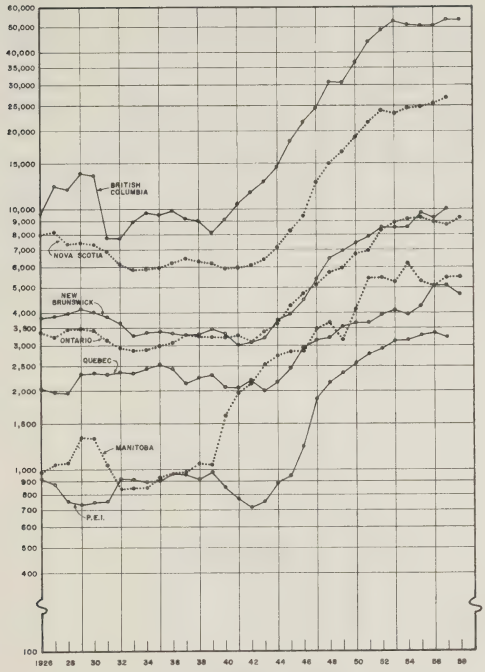
INDEX OF PRICES PAID TO FISHERMEN AND GENERAL WHOLESALE INDEX, CANADA 1926-59
(1935-39=100)



Source: Economic Annalist, Dept. of Agr., Ottawa; and Dept. of Fisheries Data.

— FIGURE 4 —

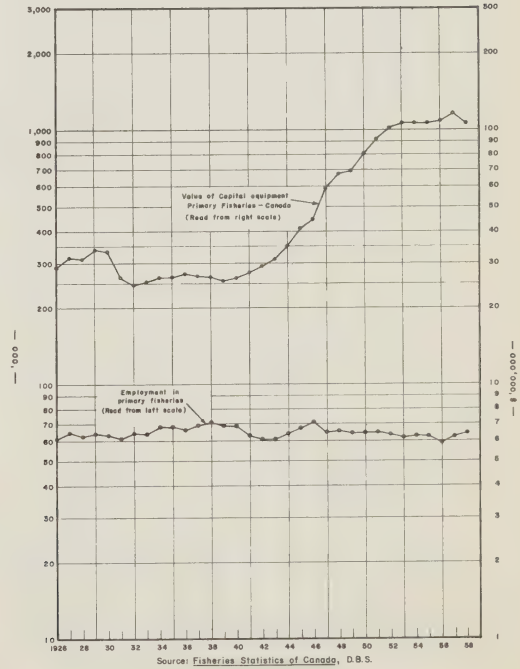
CAPITAL INVESTMENT BY PROVINCES 1926-58



Source: Fisheries Statistics of Canada, DBS

— FIGURE 5 —

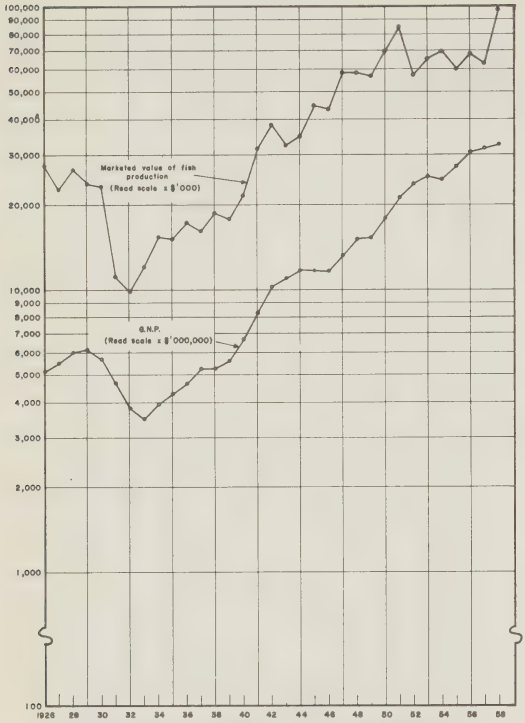
EMPLOYMENT AND VALUE OF CAPITAL EQUIPMENT IN THE PRIMARY FISHERIES OF CANADA 1926-1958



Source: Fisheries Statistics of Canada, D.B.S.

– FIGURE 6 –

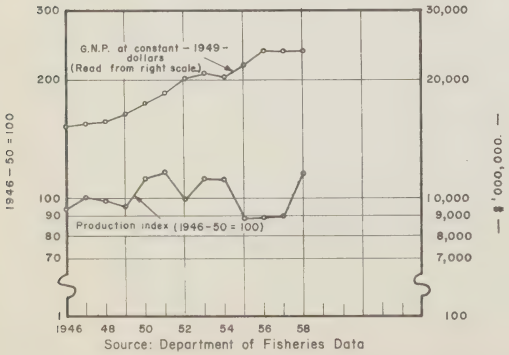
MARKETED VALUE OF FISH PRODUCTION BRITISH COLUMBIA AND G.N.P. AT MARKET PRICES 1926 – 58



Source: Fisheries Statistics of Canada; D.B.S. & National Accounts 1926–58, D.B.S.

– FIGURE 7 –

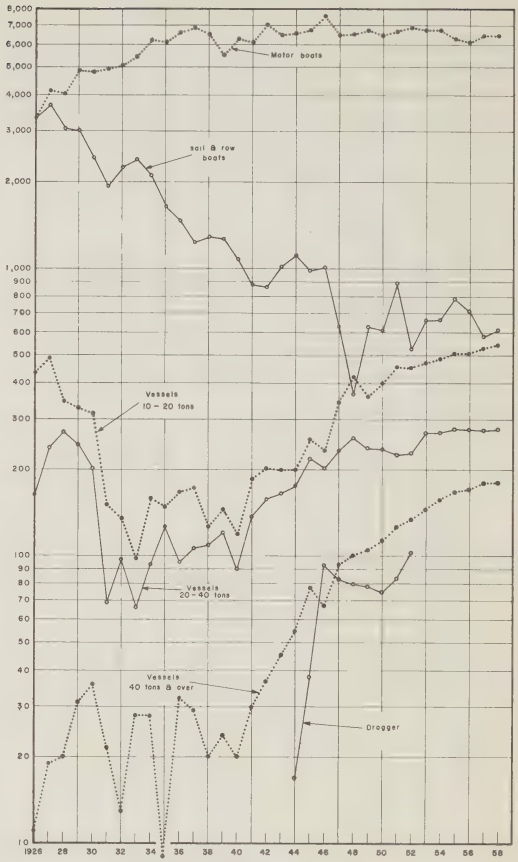
INDEX OF VOLUME OF LANDINGS IN BRITISH COLUMBIA AND G.N.P. AT CONSTANT – 1949 – DOLLARS, 1946 TO 1958



Source: Department of Fisheries Data

– FIGURE 8 –

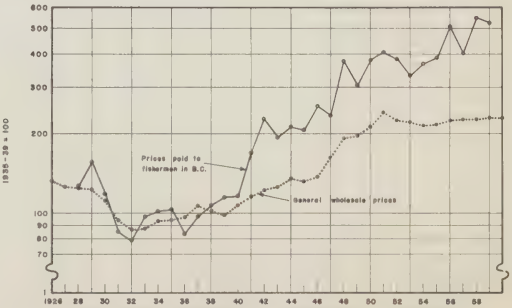
FISHING CRAFT – BRITISH COLUMBIA – 1926 – 1958
(Grouped by size)



Source: Fisheries Statistics of Canada, D.B.S.

– FIGURE 9 –

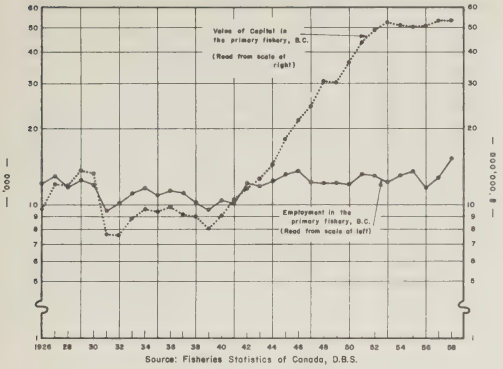
INDEX OF PRICES PAID TO FISHERMEN IN B.C. AND GENERAL WHOLESALE INDEX, CANADA 1926–59
(1935–39 = 100)



Source: Economic Annalist, Dept. of Agr., Ottawa; and Dept. of Fisheries Data.

— FIGURE 10 —

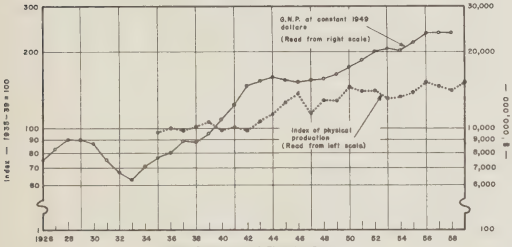
EMPLOYMENT AND VALUE OF CAPITAL IN THE PRIMARY FISHERY OF BRITISH COLUMBIA
1926 — 1958



Source: Fisheries Statistics of Canada, D.B.S.

— FIGURE 11 —

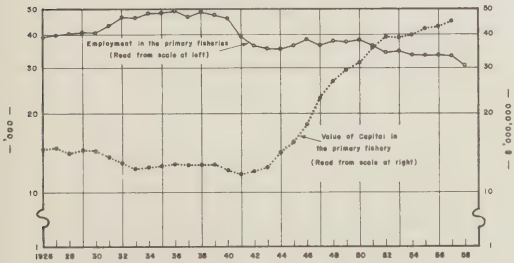
INDEX OF PHYSICAL PRODUCTION, MARITIMES AND QUEBEC (1935-39=100)
AND GROSS NATIONAL PRODUCT AT CONSTANT-1949-DOLLARS



Source: Department of Fisheries Data.

— FIGURE 12 —

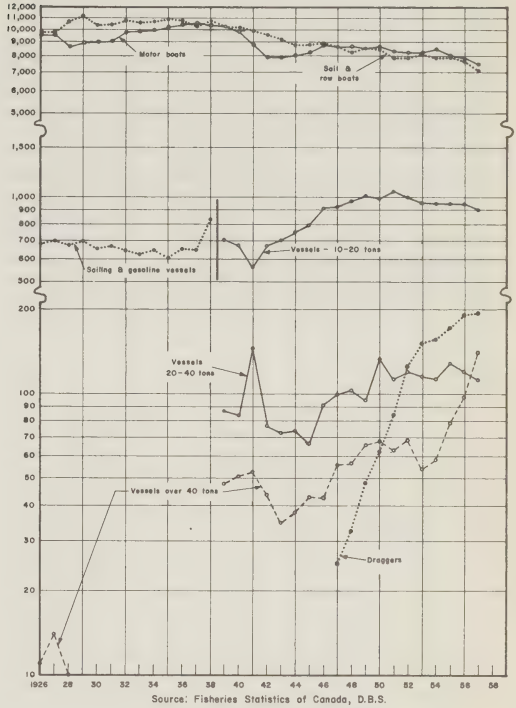
EMPLOYMENT AND VALUE OF CAPITAL IN THE PRIMARY FISHING INDUSTRY OF THE
MARITIMES AND QUEBEC 1926-1958



Source: Fisheries Statistics of Canada, D.B.S.

— FIGURE 13 —

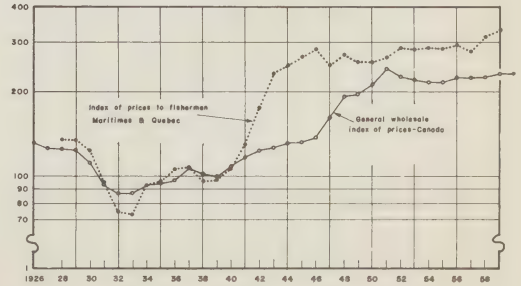
NO. OF FISHING CRAFT MARITIME PROVINCES
1926 — 1958



Source: Fisheries Statistics of Canada, D.B.S.

— FIGURE 14 —

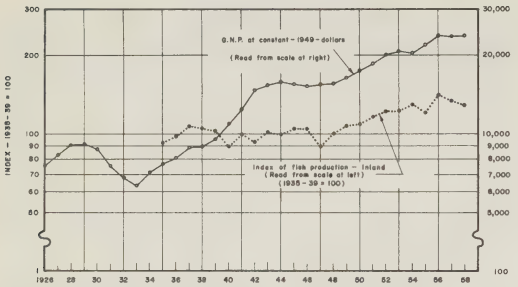
INDEX OF PRICES PAID TO THE FISHERMEN OF THE MARITIMES AND QUEBEC
AND THE CANADIAN GENERAL WHOLESALE INDEX
(1935-39=100)



Source: Economic Annalist, Dept. of Agr.; and Dept. of Fisheries Data.

— FIGURE 15 —

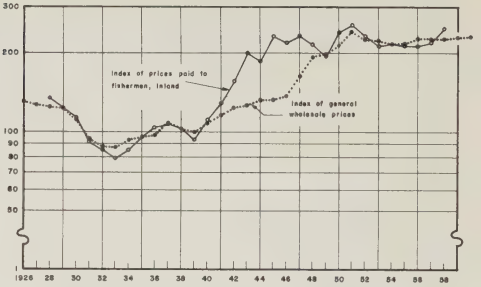
INDEX OF PHYSICAL VOLUME OF PRODUCTION, INLAND AND GROSS NATIONAL PRODUCT AT CONSTANT – 1949 – DOLLARS



Source: National Accounts, 1926–1958, D.B.S.; and Dept. of Fisheries Data.

— FIGURE 16 —

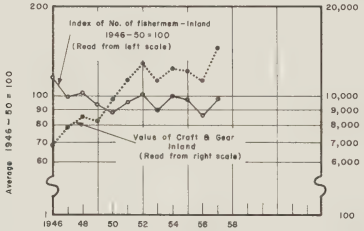
INDEX OF PRICES PAID TO FISHERMEN, INLAND AND GENERAL WHOLESALE PRICES (1935-39=100) 1926 — 1958



Source: Economic Annalist, Dept. of Agr.; and Dept. of Fisheries Data.

— FIGURE 17 —

VALUE OF FISHING CRAFT AND GEAR, INLAND AND INDEX OF NO. OF FISHERMEN, INLAND 1946 — 1957



Source: Fisheries Statistics of Canada, D.B.S.; and Dept. of Fisheries Data.

Notes and References

FOOTNOTES

[1] These are plotted on semi-log scales to facilitate comparison. A straight line plot for any series indicates a constant rate of increase, and parallel curves indicate equal rates of change for different series.

[2] Data for the 1952-1959 period provided by Economics Branch, Department of Trade and Commerce, show annual outlays on new vessels ranging from $2,400,000 to $4,858,000.

[3] It is tempting to add the further assumption that such improvements, will not be banned forthwith as conservation measures. This problem is treated in a later section.

[4] The lobster fishery might be considered an exception, but the development of something akin to property rights in lobster grounds results in quite different economic behavior than is found in the completely *open* salmon and halibut fisheries.

[5] The most important are the absence of reliable series for incomes and for prices beyond the fisherman level.

REFERENCES

Canada Department of Fisheries and the Fisheries Research Board of Canada. *The Commercial Fisheries of Canada*. Royal Commission on Canada's Economic Prospects. Ottawa. 1957. 193 pp.

Buchanan, D.R. and B.A. Campbell. *The Incomes of Salmon Fishermen of British Columbia, 1953-54*. Canada Department of Fisheries. Ottawa. 1957. XI + 110 pp.

The Demand Outlook for the Canadian Fisheries

W. C. MacKenzie,
Director, Economics Service,
Canada Department of Fisheries,
Ottawa, Ontario

Except for two or three products such as fish meal and cured codfish, the future of which is at present doubtful, the demand for all products of the Canadian fishing industry may be expected to increase. This means that, except for the species in relatively elastic supply, raw-fish prices will continue to rise. In addition to the more obvious cases such as lobster, salmon and pikeperch, certain of the ground fish species utilized for the fillet trade, for example haddock, are likely to be affected, as well as a number of rather minor species such as swordfish and perch. The price of Atlantic herring, on the other hand, appears unlikely to be affected, and the effect on the price of cod depends on the outcome of the inter-form competition for this species: if the current shift from curing to filleting continues, there is unlikely to be much change in the price of cod for some time to come.

Two general inferences flow from these conclusions. The first is that, in the fisheries based on species inelastic in supply, rising prices will continue to attract excessive inputs of labor and capital, creating progressively refractory problems in the field of fishery management or resource conservation. The second is that industrial development based on utilization of the Atlantic demersal stocks will continue to be encouraged by an expanding demand, but that margins will be narrow and an increase in productivity will remain urgent. It is to the questions posed in these two fields, fishery management and industrial productivity, that policy must be directed.

Introduction

The term *demand* is used here primarily in the sense of the quantity demanded in retail markets. This demand is an aggregation of the separate demands of households and of individuals who patronize public eating places. The demand for fishery products, like that for other classes of commodities, is related to a) the prices of these products, b) the prices of substitute and complementary products and c) the number, income and dietary habits of consumers.[1]

The functional relationship among the basic factors may be stated in the form of an equation, and this is often useful in determining the shape of demand curves or surfaces, the direction and causation of shifts in such curves and for other purposes of demand analysis. Given the empirical data required, estimates of the parameters, e.g. demand elasticities, may be obtained either a) from time-series of consumption, prices, income and population or b) from household budgets representing a cross-section of the market or c) by combining these sources.[2]

The usefulness of equational statements of demand is restricted by certain necessary simplifying assumptions. To begin with, it is assumed that the elasticities of demand are constant. In the case of fishery products, there is reason to suspect that demand curves tend to be *kinked*, i.e. that price elasticity is greater above than below the current price range. Thus, while there is some evidence that when fish prices rise in relation to meat prices the demand for fish may be affected adversely, there is no evidence that a relative drop in fish prices has an equal and opposite effect.[3] Income elasticity, on the other hand, usually decreases as income increases and, since demand must have a saturation point, ultimately approaches zero.[4] Families with incomes over $6,000, for example, spend, on the average, about 20 per cent of their income on food, in contrast with those in the less-than $2,500 bracket which spend nearly 40 per cent for the same purpose – the figures apply to the domestic market in Canada in the mid 'fifties.[5]

Moreover, in a demand equation as usually formulated, the influence of supply factors is not taken into account. In no case, however, not even in that of herring products, is supply infinitely elastic. In general, price is determined by the simultaneous action of demand and supply and, as the evidence to be presented will indicate, the role of supply factors appears sometimes to be dominant.

Finally, and unhappily, the empirical data available for the calculation of the demand parameters with which we are concerned are rudimentary. In forecasting the demand for fishery products of Canadian origin, we have to rely on a somewhat heterogeneous mass of information, varying for the most part only in degrees of inadequacy. In summary, it includes:

1. Comprehensive and detailed statistics of a) the production of the Canadian fish-processing industry and b) the import into and export from Canada of fishery products.
2. Incomplete statistics of a) inventories and b) wholesale and retail prices of fishery and other food products in Canada.
3. Indices of the prices of consumer goods and of personal disposable income in Canada.
4. Reports of surveys, restricted in scope and uncertain as to representativeness, of the pattern of consumer expenditure for food (including fishery products) in Canada.
5. Comparable data for the United States and a few other markets abroad.

The data on production, foreign trade and inventories permit a reasonably accurate calculation of the domestic retention of the products of the fishing industry in Canada. Over-all, this currently averages 30 per cent. For separate sectors of the industry, it varies from about 70 per cent for Pacific salmon products to 10 per cent for the products of the freshwater fisheries. It is about 20 per cent for Atlantic *ground fish* products. In a few minor cases, e.g. oysters, the Canadian market absorbs the total production. Canadian consumption of imported fishery products, although increasing, is relatively low, consisting principally of items unavailable or in short supply from the domestic industry, e.g. shrimp and tuna products.

By far the most important export market is in the United States, where 50 per cent of the total Canadian output of fishery products is sold. The remaining 20 per cent finds an outlet in some 50 other countries, the more important being located in northwestern Europe and in the Mediterranean and Caribbean regions. As shown later, the North American markets are broadly differentiated from the others by the nature of the products preferred, i.e. fresh and frozen as against cured fish products. Canned fish products find acceptance in both groups of markets – as do also the non-food or industrial fish products of Canada.

The available statistics of production and distribution, in association with population statistics, also permit calculation of the per capita consumption of fishery (food) products in Canada and in some of the export markets. In all cases, the resulting measures are vitiated to some extent by the quality of the basic data, particularly those relating to inventories. The current figure for Canada is 13.5 pounds, edible weight, a year – as compared with 145.6 pounds of meat, 25.3 pounds of poultry and 36.8 pounds of eggs. During the past decade or so, annual per capita fish consumption in Canada has increased by 5.5 per cent while that of the group of (presumably) more or less substitutable animal-protein products as a whole has increased by about 11.5 per cent. During the period, total per capita food consumption has been stable at just over 1,400 pounds a year (retail weight).[6] Household expenditure for fish evidently averages somewhat over half of that for poultry and eggs, about 10 per cent of that for meat and hardly more than two per cent of that for all food products. Similar levels and trends have been observed in the United States.[7]

The studies[8] of consumer behavior in these two countries, despite their limitations, indicate that, while meat and other farm products enjoy virtually universal acceptance, the acceptability of fishery products is restricted to a segment of the population. In the United States, for example, the situation appears to be as shown below:

Product Group	Consumers as Proportion of Total Population
	per cent
Fresh Fish	70
Frozen Fish	50
Cured Fish	20
Canned Fish	75 – 80
Shellfish (all forms)	20 – 25

Further clarification is provided when the consumers of a product are classified according to frequency of consumption. In the case of canned fish, the product form in widest use, this works out roughly as follows:

Consumer Classification[9]	As Proportion of All Consumers
	per cent
Sporadic	50
Light	35
Heavy	15
	100

A wide locational variation in per capita fish consumption is also indicated. It is higher in coastal and lakeshore districts than inland, and higher in urban centres than in rural areas – in certain coastal cities a figure of 35 pounds a year has been recorded. An impression of the urban pattern across Canada during the past decade may be gained from the following data:[10]

City	Average Weekly Household Expenditure for Fish	As Proportion of Total for All Foods
	$	per cent
Vancouver	0.53	2.5
Winnipeg	0.39	2.0
Toronto	0.48	2.2
Montreal	0.45	1.8
Halifax	0.76	3.8

The higher rate of consumption in urban centres is attributable a) to distributive channels running through these centres and b) to the fact that about 40 per cent of the total consumption of fishery food products takes place in public eating places and in institutions, i.e. hospitals, prisons and the like. The relatively high consumption rate observed at coastal points is explained by the existence in such locations of a traditional preference for fish, based no doubt on the accessibility of high quality supplies at low prices.

This is of particular significance in the assessment of the future demand for fishery products in the markets of North America. The available evidence suggests that the *fish-eating* segment of the population on this continent is composed largely of a) European settlers of the first generation and their immediate descendants, b) migrants from the Atlantic states and provinces and from other coastal or lakeshore areas and c) certain other groups, perhaps, with an acquired taste for fish as a food. Between 75 and 90 per cent of consumer-respondents in surveys report having been served fish in childhood. The implication is that, like food preferences in general,[11] those for fish tend to follow habitual patterns. Evidently, also, impulse buying plays an insignificant role in family expenditure on fish products.

Demand prospects, therefore, relate to the extent to which the segment referred to may be expected to expand or contract, and would appear to depend mainly on the rate at which defectors are replaced by recruits. The point is emphasized because it seems unlikely that real per capita rates of fish consumption will increase substantially. In the conditions imposed by the level of living prevailing in North America, an increase in per capita fish consumption involves the displacement of other food products in consumers' schedules of preference. Such a development, other than on a comparatively negligible scale, is improbable. In recent surveys of consumers, up to 80 per cent of the respondents indicated that they would not increase their consumption of particular fish products under any circumstances.

On the other hand, during the past decade at least, per capita expenditure for food in Canada has been remarkably stable at 20-25 per cent of personal disposable income, showing a very slight tendency to move inversely with income. At the same time, despite intense competition in the food-merchandizing business, the per capita consumption of animal-protein food products, including fishery products, has remained either constant or has shown a tendency toward modest increase – possibly reflecting the growth in material well-being in this period.

All this would imply that, in the short run at least, the demand for these products is not very responsive to price changes, i.e. it is inelastic. The conclusion is confirmed from independent sources.[12] In general, coefficients of price elasticity for food products usually are found in the range from – 1 zero — cross-elasticity coefficients naturally are more widely distributed. Those for specific groups of fishery products apparently tend to cluster about –0.6 or –0.7,[13] i.e., with price in the role of independent variable, a change in price tends to be associated with a change in demand about two-thirds as great in the opposite direction. Such global parameters, while providing an insight into past changes in demand, are, as already suggested, less useful as a guide to the way in which demand will be affected by economic factors in the future. Coefficients of income elasticity for fishery products tend to be concentrated in the upper part of the range between zero and +1, but the interpretation of these is uncertain. In the long run, the demand for fishery products may be quite elastic: dietary habits being gradually adapted to changing market conditions.[14] It is also evident that the elasticity of demand for processing and related services tends to be greater than that for the food to which these are applied.[15] In Canada, for example, in this connection, over the decade of the 'fifties, it has been estimated "...that marketing costs per unit of fish marketed increased 47 per cent as a result of a 24 per cent increase in the amount of services and a 19 per cent increase in the price of a unit of marketing service,"[16] reflecting the shift to advanced forms of preparation, packaging and facilities for the handling of fish food products.

Demand Projection: Retail Markets[17]

As the reader will have inferred, consideration of the demand projections for Canadian fishery products should be approached with caution. The meagre data on which such projections may be based pertain to the period 1949-59 only – a number of essential statistical series are wholly unavailable for earlier years. The period is short for our purposes but, in respect of the general economic climate, it conforms with expectations for the foreseeable future.

Within the specific group of Canadian fishery products, numbering altogether some 500 distinct and identifiable items, there appear to be several more or less non-competitive subgroups. Ignoring minor items, these are as follows:

1. Food products,
   a. Fresh and frozen fish –
      i. Lobster
      ii. Salmon
      iii. Lake fish (major species)
      iv. Ground fish
   b. Cured fish (cod and related species)
   c. Canned fish (salmon and herring)
2. Non-food products.

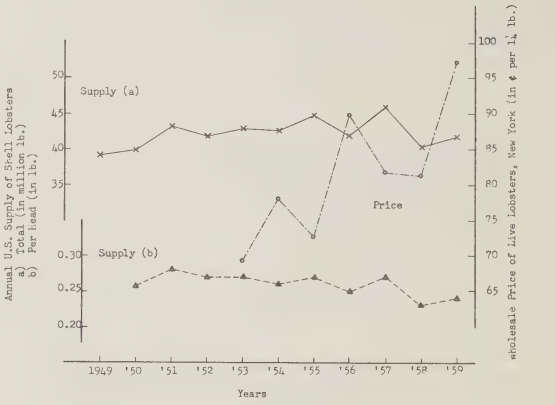
Non-substitutability is absolute, of course, as between food and non-food products. On the other hand, some degree of substitutability probably exists among a wide range of fish food products: being relatively high within each subgroup, e.g. among the items included in a.ii, iii and iv, and relatively low as between a., b. and c.

In retail markets, therefore, we are concerned not with a demand for fishery products in general but with a number of separate demands associated with particular products or with relatively homogeneous groups of products. In each case, demand is a function of a more or less unique set of factors, depending, among other things, on the market orientation of the products involved, e.g. the ratio of export to total sales.

Fresh and Frozen Fish

The current situation in the market for *fresh lobster products* (live and frozen shell lobsters and lobster meat) approaches perhaps the ultimate stage of development in the fish trade – crabs, oysters and, perhaps, scallops are in a like category. The rise in population and incomes in North America, combined with a relatively inflexible supply of lobsters – the annual *crop* is considered to be close to the maximum consistent with conservation of the stocks – has raised the price of these products to the luxury level. Consumption generally is restricted to the higher-class restaurants and clubs, where lobster often is featured in the most expensive meals listed. The strength of the demand for lobster products is related basically to their taste appeal, probably, but an element of *conspicuous consumption* is now present as well. The dominant factors in its determination are those impinging on the market in the United States, where 60-65 per cent of the production is exported and where these exports constitute about half the total supply. A continuous growth in population, in association with a relatively stable supply, as shown in Fig. 1, appears to exert an increasing upward pressure on lobster prices. At some point this trend may be expected to encounter a check from the substitution of competing products such as rock-lobster tails and crab meat. In the meantime, the strength of the demand for lobster in the live and frozen forms may lead to the elimination of production in the canned form – already under pressure from this direction – in Canada.

Figure 1.



Fresh and frozen salmon and halibut products (dressed, steaked, etc.) also approach the semi-luxury class – among the important allied items are swordfish and sablefish. Again the bulk of the Canadian production, about 60 per cent in the case of salmon and 50 per cent in that of halibut, is absorbed by the market in the United States; and again a steadily expanding demand, based on population growth, is associated with a relatively inflexible supply or with a supply that increases more slowly than the apparent growth in demand – although, in the case of salmon especially, this supply is considered to be capable potentially of a substantial expansion. The result has been a trend in prices similar to that for lobster. Fresh and frozen salmon and halibut, when distributed under proper conditions, possess properties of texture and flavor that earn them a preferred position with consumers. At present, quality

suffers from the protracted storage required as a result of the short production season. If this were remedied, through improved fishery-management practices and progress in the application of food technology, the appeal of these products might be further enhanced.

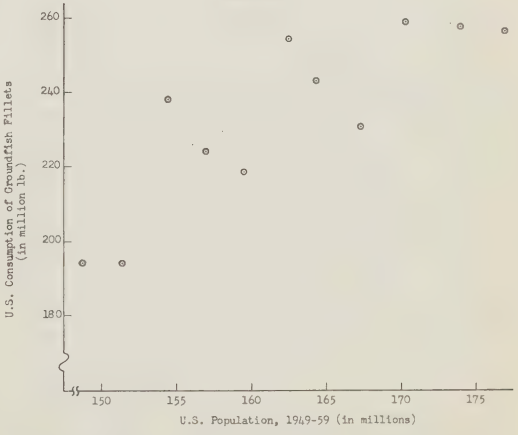
As mentioned earlier, the United States market dominates almost completely the trade in lake or *fresh-water fishery products* – whitefish and pike-perch (dressed and filleted) are the major species involved but, with the decline of the stocks in the Great Lakes (the waters in closest proximity to the market), *coarser* species are being drawn upon. Total supply is expansible but only under conditions of higher cost, i.e. by bringing more remote lakes into production. The demand for lake fish is closely associated with Jewish dietary customs. The seasonal pattern of sales is thus subject to wide variation, depending on the incidence of fast days and similar occasions. The resulting fluctuation in prices is accentuated by other factors peculiar to this trade, e.g. irregular availability of supplies due to problems of assembly from distant points of origin and other hazards, which also distort price trends to some extent.

The largest subdivision of the market for fresh and frozen fishery products is that of the so-called *ground-fish group*. This group of products – fillets, sticks and portions (raw and pre-cooked) originates mainly in the demersal fisheries of the Atlantic coast, i.e. the fisheries for cod, haddock, redfish, the smaller flatfishes and a number of other species of lesser importance. Similar products originating on the Pacific coast are supplementary to the main source of supply. The frozen forms are dominant. Production in Canada developed largely in response to demand in the United States, where it was closely associated with the expansion of facilities for handling frozen foods throughout the channels of distribution and the use of these foods in households. The United States market is still overwhelmingly the most important outlet for the Canadian trade.

This group of products probably competes more directly with protein foods of agricultural origin than do other fishery products. There appears to be little if any relationship between the respective price levels, however. Sensitivity to short-run changes in the market may be obscured by the buffer effect of inventories, which are capable of very rapid adjustment. In the United States market, Canadian frozen fillets and allied products also compete with similar fish products of domestic origin and with those imported from other countries, notably Iceland and Norway. In this respect, the conditions surrounding this branch of the Canadian export trade differ from those relating to the other fish products discussed above. One aspect of this is that the tariff protecting the national fish-processing industry, negligible or non-existent in the case of those products, amounts to a substantial impediment (about 13 per cent ad valorem) for ordinary ground-fish fillets – and the intermediately processed frozen blocks – and is prohibitive (at 30 per cent ad valorem) for cooked fish products.

With reference to the competition of other imported supplies in the United States market, while setbacks to the growth of the Canadian trade have occurred from time to time, these are attributable to certain weaknesses in the business organization associated with the processing and sale of this group of products in Canada – there is evidence, for example, that a considerable degree of overcapacity exists in the processing phase of the industry. It is anticipated that expansion of opportunities for the sale of frozen fish on the continent of Europe will attract a progressively larger share of Icelandic and Norwegian exports or, alternatively, strengthen the position of the Canadian trade by providing it with additional outlets. The Canadian export component in current United States supplies amounts approximately to 50 per cent of the total. A basis for projection of the export demand exists, therefore, in the relationship between the trend of gross consumption and that of population in the United States during the base period, as shown in Fig. 2. Consumption per person remained stable at just under 1.5 pounds throughout this period.

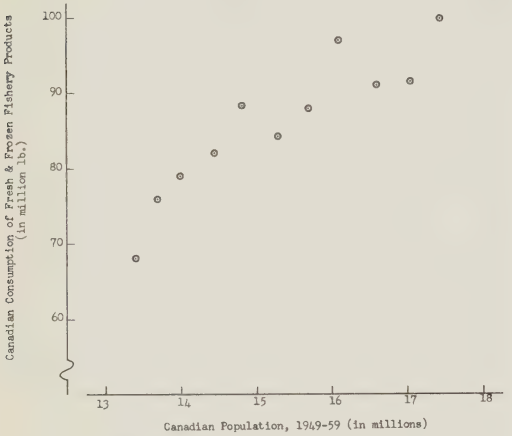
Figure 2.



Projection of the Canadian domestic demand presents greater difficulties. This applies to the whole range of fresh and frozen fishery products. No

relationship exists between population, for example, and the domestic retention (consumption) of any of the major products individually. When similar products are combined, however, a definite relationship begins to emerge, and, when the whole group of products is aggregated, a clear relationship with total population is established for the 1949-59 period, as demonstrated in Fig. 3. Consumption per head, in terms of weight at retail, hovered close to 5.5 pounds a year throughout the period.

Figure 3.



This somewhat paradoxical result, in view of the preceding discussion, admits of partial explanation. Underlying the regional variation in fish consumption generally, mentioned earlier, are variations of greater amplitude in the consumption of particular fishery products: a tendency exists for consumption to be highest in districts contiguous to the waters from which a product is derived and to decline with distance from that location. Compensating this tendency is the broad acceptance of products such as steaked salmon and halibut and fillets of ground fish.[18] Despite the disparity in price and other characteristics among them, a degree of substitution occurs throughout the range of fresh and frozen fishery products, affecting consumption within certain income brackets particularly in areas where a selection of the products is generally available.

Selection sometimes may be involuntary, because of the nature of the market in Canada. The extent of the orientation of the trade in these products toward the United States market, arising from the importance of sustained volume sales in merchandizing operations, has been described. It would suggest that service of the demand in the United States market is a first charge on Canadian production and, consequently, that the domestic market is served with residual supplies.[19] The hypothesis here is a) that, to satisfy a preference for fish as nearly as possible in the fresh state, consumers are prepared to make substitutions among a considerable range of products when conditions of availability and/or price provide an inducement to do so, and b) that the apparently homogeneous demand for this quite diverse group of products reflects complementarity among such local systems of substitution.

A projection of the domestic and export demands for fillets and other ground-fish products probably does not carry an implication of rising prices to the extent that projections for other products in the fresh-and-frozen group do – the stocks of demersal fish are understood to be capable of supporting a greatly intensified fishery. Nevertheless, an upward movement in the price of these products may be anticipated as the result of a) the higher production costs – barring continuous progress in fishing and processing efficiency – incurred in the utilization of thinner and less accessible stocks of smaller fish, b) the development of intercountry competition for the supply, i.e. as between the rival demands of the domestic market and the export markets in the United States and (perhaps) elsewhere, and c) the intensification of inter-form competition for raw-fish supplies, i.e. as between filleting and curing.

Cured Fish

The *salted and dried cod* (by far the most important of these products) produced in Canada traditionally has been an export commodity, in the main, and is now almost exclusively so – Canadian exports constitute about 25 per cent of the total international trade. The principal markets are found in the countries of the Mediterranean and Caribbean regions. The current average annual consumption per head in some of the more important of these countries is calculated to be as follows:

Country	Consumption per head per year
	pounds
Portugal	15.0
Puerto Rico	14.0
Jamaica	10.0
Cuba	5.0
Spain	4.0
Brazil	1.0

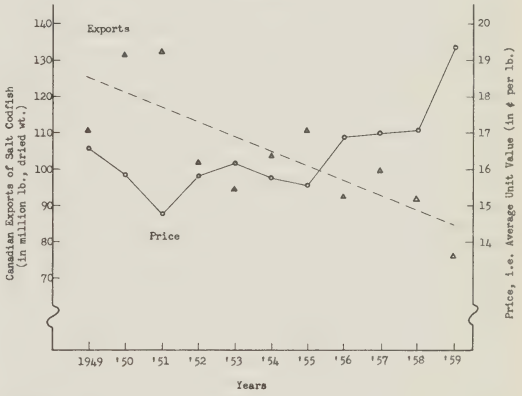
These data indicate considerable variation in the pattern of consumption as between different countries. In some of these, salt fish (or bacalao) is an important element in the national diet. In Portugal, for example, while representing but 15 per cent of the total annual consumption of animal-protein foods, it provides double that proportion of the average daily protein intake.[20] In other countries, although comparable data are not currently available, it is obvious that salt fish is a relatively insignificant article of food. In such cases, one may infer a) that it is consumed by a part of the population only and/or that consumption is restricted to special, i.e. festive or ceremonial occasions, or b) that it is not commonly used as the protein base of meals but rather as a condiment in an otherwise bland vegetable diet. Its widespread use in the last-mentioned manner, especially among plantation workers and other low-income groups in the Caribbean, has been attested.

Up to the present, according to the limited information available,[21] the demand for salt fish has tended to be inelastic with respect to both price and income – although it is known to be influenced by the availability and price of complementary commodities like rice and olive oil. A rough basis for demand projection, therefore, might be found in expected population trends in the consuming countries – supposing these were to be established – but the existence of factors tending to diminish the ratio of increase in the demand for salt fish to population growth should be recognized. The meal-base use of salt fish eventually might decline in the face of competition from fresh fish and meat of imported or indigenous origin – repeating the history of the salt-fish market in North America. Developments in this direction are already discernible in Cuba and Brazil, for example. The condiment use of the product also might decline as a result of industrialization, as in Puerto Rico and Jamaica, and the associated transfer of labor from agriculture to urban employment – in which incomes rise and modes of life are altered.

These considerations would seem to be of greater significance for the prospects of the salt-fish trade than those relating to the commercial policy of importing countries. Canadian exports have been adversely affected by the trend toward self-sufficiency in Spain and Portugal and by exchange restrictions in Brazil, for example. To a large extent, however, these developments effected a redistribution of the trade among the several exporting countries rather than a contraction of the total volume of trade. It is possible that the creation of a common market in Europe will give France, and possibly Norway and Iceland, an advantage over Canada in the important Italian market but at present assessment of this and like possibilities is subject to much uncertainty.

During the base period, 1949-59, Canadian exports of salted and dried codfish declined at an average rate of four million pounds a year. The decline, however, was brought about not by change in the demand for this product but by the diversion of raw material to the fillet trade and by other factors affecting supply. Toward the end of the period, the price, which, as shown in Fig. 4, is closely correlated with supply, had risen sufficiently to check this diversion. The current outlook is static, therefore, with prospects for the more distant future appearing likely to depend as much on the outcome of inter-form competition, localized in Canada, as on the demand situation in markets abroad.

Figure 4.



Canned Fish

The demand for Canadian *canned salmon,* unlike that for the products discussed in the foregoing paragraphs, is dominated by the domestic market. The demand, moreover, is more broadly based than that for the other products of the Canadian fisheries. This is explained not only by its palatability and convenience for use in the preparation of meals but also by its storability. Because its shelf-life is of long duration, it is capable of virtually universal distribution. Consumers' preferences related to these qualities have been developed through advertising directed a) to the differentiation of the product with respect to species (based mainly on colour differences) and b) to the identification of superiority with particular brands.

The domestic market is a protected market – the duty on imported canned salmon is 15 per cent ad valorem – and it currently absorbs about two-thirds of the total annual pack. Apparent domestic disappearance, in the 1949-59 period, remained fairly

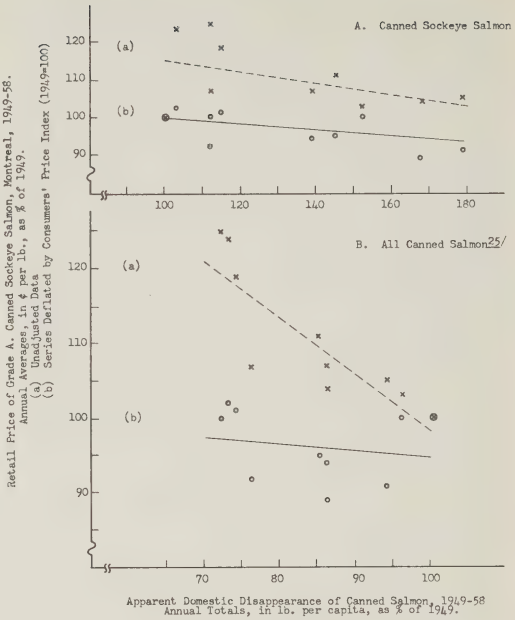
stable at 850,000 cases[22] each year. On the average, this included somewhat over 300,000 cases of sockeye salmon and about 275,000 cases of pink salmon, which are the species principally utilized for canning and the markets for which are differentiated slightly according to purchasers' income status:[23] the ratio of pink to sockeye prices at retail is about 0.6.

Since population was increasing during the period 1949-59, it follows that the per capita consumption of canned salmon in Canada was declining – from about 3¼ pounds per head to 2⅓ pounds, in fact. More significantly, perhaps, the decline was taking place concurrently with a 30 per cent increase in net disposable real income per person. It is not to be supposed that this necessarily indicates that canned salmon is an *inferior good,* i.e. that its demand is negatively correlated with income. Time series of the kind involved here are inadequate for the derivation of demand elasticities with respect to income. In addition, no doubt, the market was subject to the action of other factors during this period.

Attempts to discover a relationship between changes in consumption and changes in price, however, have yielded unsatisfactory results. Retail prices of canned salmon increased nominally by 25-30 per cent between 1949 and 1959 but, as adjusted for the movement of prices generally, they decreased by about 10 per cent during the middle part of the period and were unchanged from the initial level at the end. The data employed for the measurement of consumption, i.e. packers' domestic sales, are imperfect for the purpose, unfortunately, since adjustment for year-to-year changes in wholesale and retail inventories is not possible. It is conceivable that a substantial shift was taking place in the domestic market for canned fish during the fifties: tuna (the sales of which have been increasing), for example, being substituted for salmon – as earlier in the United States, where salmon is now the second most popular canned fish. Further investigation of the matter is required, however, before one accepts as valid the impression of extraordinarily high price elasticity for this product as conveyed by the data plotted in Fig. 5. The most that can be said is that, for the present, the domestic demand for canned salmon appears to be static in absolute terms.

A factor of undoubted importance in distorting or obscuring the effects of income and price in the domestic canned-salmon market is that of supply, in association with the competition of other forms of utilization and with that of other markets, i.e. those in foreign countries – in one recent season, to maintain a normal supply for the home market without reducing sales abroad, the packers imported considerable quantities of canned salmon from Japan.

Figure 5.



In export markets, the most important of which are located in western Europe, the Canadian product competes with similar products originating mainly in Japan and the U.S.S.R. Exports have been impeded by protective devices and import controls that make assessment of the situation in these markets difficult. There is no doubt that a strong foreign demand exists which, added to that of the domestic market, portends increasing pressure on the relatively scarce supply.

It is probable that there is some slight degree of substitution as between canned salmon and canned herring products *(sardines, kipper snacks* and others) in the Canadian market – the evidence is inconclusive. It is probable also that such products as sardines are differentiated, with respect to the count-per-tin, type of pack, i.e. whether in olive or vegetable oil or in sauce, and perhaps other properties, as between a) products used as the protein-ingredient in meals, including those prepared for export to low-income markets abroad, and b) products of the *hors-d'oeuvre* class, used as luncheon and picnic foods. In the domestic market for the second group of canned herring products, unlike that for canned salmon, those of Canadian origin compete

with a rather wide range of similar products imported from Europe and elsewhere, the volume of which has been increasing rapidly in recent years.

It is not possible to discern any clearly-defined trend in the Canadian consumption of domestic *canned herring* products. This suggests that, as frequently in this field, market forces are less significant as determinants of the consumption level than are certain other factors. The raw-material source, the Atlantic herring runs, is subject to the vagaries generally characteristic of the species: in seasons of scarcity supplies for the canneries must be imported and at other times large surpluses are turned over to the pet-food and reduction plants. The size of the fish obtained is also important, for the reasons described in the last paragraph. Market requirements, therefore, may often be subordinated to the outcome of the annual catch. A firm domestic demand has been maintained over a long period, however, supplemented by a durable foreign demand, and there is no reason to doubt that these will persist into the future.

Fish Meal and Oil

Meal and oil, joint products of the fish reduction industry, are the principal products in the non-food group and the herring fishery of the Pacific coasts is by far the most important source of supply in Canada. A large quantity of *whitefish* meal originates as a by-product in the Atlantic fish-processing industry but, while the sale of this product is a profitable adjunct to filleting operations, it does not involve a net addition to the demand for raw material. Cod oil, seal and whale oils and a number of other minor items may be neglected also in the present context.

The demand for fish meal is based on its use as a component of high-protein feeds for farm animals and is thus related to the numbers of livestock on farms – and to the feeding practices of the growers. The market is international and, as in the case of salt fish, there exists something in the nature of a *world* price. In this market, fish meal competes with protein concentrates of agricultural origin: soybean, linseed and rapeseed meal, brewers' and distillers' dried grains and packing-house by-products. Fish meal approximates five per cent of the total supply on the Canadian domestic market. In addition to the known nutrients present in protein meals generally, fish meal contains some, known as *growth factors,* that have not been isolated and identified, which enabled it until recently to maintain its place in the market in competition with the substitutes mentioned.

Currently, however, fish meal is in oversupply internationally – mainly as a result of the rapid development of Peruvian resources – with catastrophic repercussions on the price of the product. The development of synthetic substitutes is a further contingency. The future therefore is uncertain – perhaps temporarily. Much will depend on the outcome of interaction between market forces and the cost-price structure of the reduction industry. In any event, when the still largely untapped reserves of Atlantic herring are taken into account, no conceivable growth in demand could place a serious strain on the raw-material supply in Canada.

The market for herring and other marine oils is marked by a) a wide range of substitutable oils and fats and b) a high degree of concentration in the oil-using industries. Marine oils constitute altogether only slightly more than five per cent of the total industrial consumption of this group of products in Canada, normally, and somewhat less than that proportion in the United States – in Europe these oils have a much more extensive use in industry. Soap manufacture provides the main outlet for Canadian herring oil at the present time.

The supply of competitive products is subject to wide variation unrelated to demand factors, in part owing to the fact that several of the vegetable oils, e.g. cottonseed oil, and most of the animal fats, e.g. rendered lard and tallow, are by-products of industrial processes or are produced in necessary conjunction with other commodities. The demand for herring oil, therefore, dependent as it is on the production, and indirectly on the price, of cotton, pork, etc., tends to be unstable. The supply, depending on the herring runs – which are notoriously capricious, as has been mentioned, and the oil content of which varies considerably – tends to be equally unstable. Barring unforeseen developments, the outlook for herring oil is tied to that for herring meal, which has been the leading product of the reduction process for some time but the future demand for which, as has been noted, is unpredictable as this is being written.

Summary

A review of the conditions underlying the trends in the production and consumption of Canadian fishery products in the recent past, insofar as the information at our disposal permits, suggests that these products fall into three broad classes:

A. Products with static or declining demand
    1. Cured fish
    2. Fish meal

B. Products with growing demand and (relatively) inelastic supply[25]
    1. Fresh and frozen dressed fish
        i. Lobster
        ii. Salmon and halibut
        iii. Major freshwater species

2. Canned salmon

C. Products with growing demand and elastic supply

1. Fresh and frozen fillets of ground fish
2. Canned herring

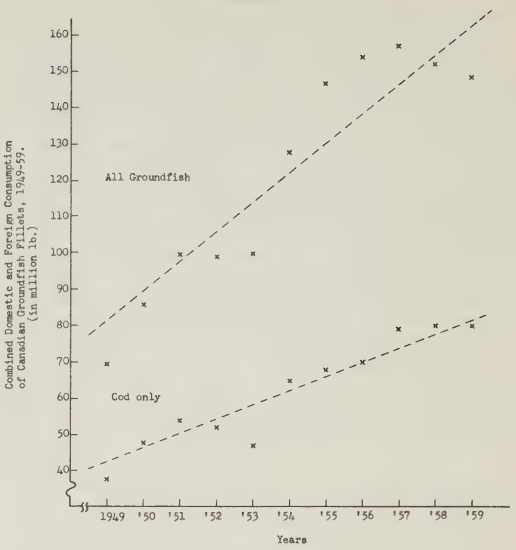
There will be disagreement with the writer's selections under this classification, probably, but few would quarrel with the classification in principle. It applies, of course, only to the current period. Improved fishery-management practices may result at some future date in the transfer of salmon products, for example, from Class B. to Class C. On the other hand, at some future date, the ground-fish supply may become much less elastic than it is now. Consideration of demands that may eventually emerge for the products of lightly exploited resources, e.g. Atlantic mackerel, and unexploited resources, e.g. Pacific saury, is omitted here – the fact is that no such demand exists at the present time.

For most Canadian fishery products, then, implications of demand forecasts relate mainly to price levels and marketing organization. Only in the case of the *ground-fish fillet* group and (perhaps) in that of canned herring are increases in physical volume, and hence an expansion in utilization of resources, involved. As indicated previously, it has not been possible to establish a trend for canned herring in the base period but, in any event, expansion is so gradual in relation to the extent of the resource that it may be neglected for the time being. The 1949-59 trend in demand for ground-fish fillets, however, as shown Fig. 6, is quite well defined.[26]

During this period, the demand for ground-fish-fillet products increased at an average rate of nine million pounds a year. Translated into terms of raw material, the figure represents a landed catch of 27 million pounds, i.e. the production of five deep-sea draggers of the size and efficiency of those now in use on the Atlantic coast. It will be noted, however, that the growth in the demand for cod fillets during the period under survey was more than offset by the decline in that for salt cod, as shown in Fig. 4, i.e. in this case a shift in raw-material utilization was involved rather than a net increase in the demand for raw material. If demand projection is based on the trend over the past decade without modification, it is implied that fleet capacity would be increased by the addition of five new draggers or their equivalent each year. If the offsetting decline in salt-fish production were to continue, new vessel requirements would be reduced to two draggers each year. On the basis of our assessment of the relevant factors here, a short-range projection of the former magnitude might appear to be justified.

The base-period trend may also be considered as a *first approximation* to a demand projection for the more distant future, but no more than that. Of one thing only we may be sure: that the current outlook will soon be modified by events.

Figure 6.



The results of our argument so far are summarized in the following table. The products included represent about 80 per cent of the total Canadian production.

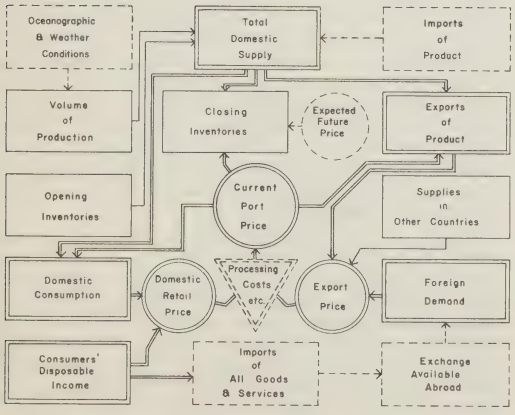
Demand in Port Markets

The discussion hitherto has been concerned with the demand for fishery products at retail, although occasional reference has been made to the probable impact on port or dockside prices of intensified competition among the alternative uses of scarce raw material, i.e. fish landings. The demand for landings at fishing ports is derived ultimately from the demand for the products into which these landings are converted. Allowing for time-lags and expectations, the current price for the landings of a particular species of fish is related interdependently to a) the retail price(s) of the end-product(s) – less charges for processing and distribution, b) the prices of other species available to the fishing enterprises involved and c) the supply of the species in the market, i.e. carryovers, if any, plus landings. For a given marketing period (year), the system of relationships among these variables may be illustrated as in Fig. 7. For purposes of clarity, the system is somewhat oversimplified.

ESTIMATED ANNUAL INCREMENT
IN DEMAND FOR SPECIFIED PRODUCTS OF THE CANADIAN FISHERIES

Product Group	Current Quantity Demanded millions of pounds	Average Annual Increment, 1949–59	
		Product Weight millions of pounds	Weight as Landed millions of pounds
Fresh and frozen:			
Round and dressed –			
Lobster (in shell)	30	+	
Salmon	40	+	
Halibut	25	+	
Whitefish, Pikeperch, Grey Trout	45	+	
Filleted –			
Cod	75	4.5	12.5
Haddock	40	2.0	5.0
Redfish	15	1.0	3.5
Flatfishes	25	1.5	6.0
Cured:			
Salted and dried –			
Cod	95	–	
Canned:			
Salmon	75	+	
Herring	20	+	
Meal:			
Herring	70	–	

Figure 7.

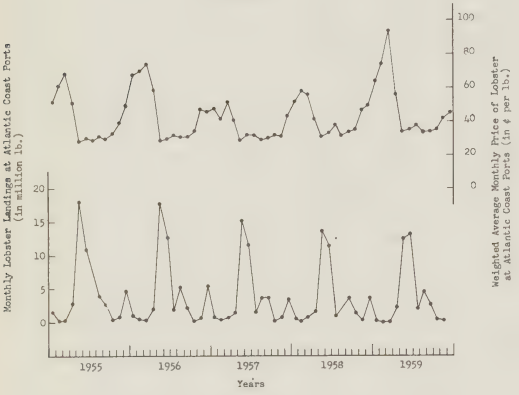


It is commonly supposed that the most effective mechanism through which demand influences may be brought to bear in port markets is the fish auction or exchange. The chief advantage of the auction is that, where supplies must be allocated in accordance with a rapidly fluctuating demand, it permits an almost instantaneous adjustment in price for that purpose. Unless the number of buyers is large, however, collusion among them may nullify this advantage. The auction's other function, viz. the adjustment of price in accordance with variation in quality of the fish landed, may be discharged equally well, perhaps, by means of contract prices based on grades. In any event, when landings are purchased mainly for processing, the sensitivity of price to rapid change in the retail market loses its significance.[28] It is for this reason, probably, that, outside the Pacific halibut fishery, the auction is unknown in Canada.

A type of port market does exist, however, in which prices appear to be quite sensitive to short-run changes in demand and supply factors. The most import-

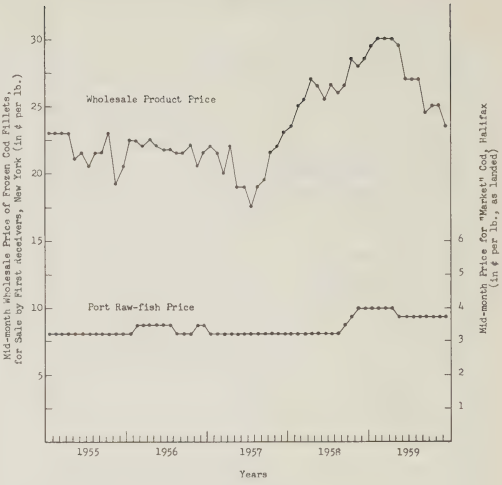
ant case in point is that of *market* lobsters, i.e. lobsters other than those for the *canner* trade, but the group also includes lake fish from certain areas entering the fresh (i.e. unfrozen) fish trade, swordfish and a few others. The significant feature of such markets seems to be that a minimum of processing and storage is involved – the fish being moved almost directly from dockside into consumption. In these cases, prices tend to fluctuate from day to day against a typical seasonal pattern, related, as exemplified in Fig 8, to the supply position.

Figure 8.



In all other cases, fish prices at Canadian ports are more or less invariable throughout the fishing season. In some cases, the price is negotiated through a collective-bargaining process and fixed by agreement between buyers' and fishermen's organizations. The annual or biennial contracts for the Pacific salmon species are the outstanding example. The contract prices often are minimum prices and they tend to be exceeded, sometimes substantially, in practice as a result of the pressure of competition among the buyers for raw-fish supplies. In the remaining cases, the price for the season evidently is established through a concensus of the leading buyers, usually firms engaged in processing and marketing on a large scale. Occasionally the price is adjusted during the season, e.g. to provide an inducement for winter fishing. Although, in most instances, exhibiting little variation from year to year, prices of the latter type frequently are managed so that the losses of one season may be recouped in subsequent seasons. The pattern followed by such prices is exhibited in Fig. 9, for purposes of contrast with the pattern shown in the preceding figure.

Figure 9.



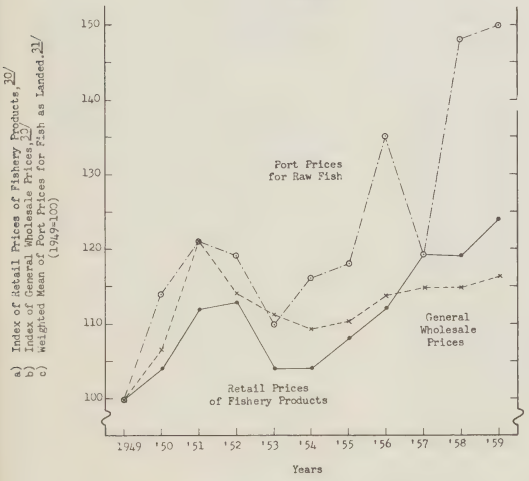
Since the intensity of fishing, i.e. the rate of exploitation of fishery resources, is related to the demand for fish products through the market mechanism, the persistence of a relatively inert price structure for something like two-thirds of the total landings at Canadian ports merits attention. The wholesale and retail prices of fish have tended to vary less than meat prices, due to fixed markups at those levels, but this tendency probably disappears as the distribution of fishery products is taken over progressively by the grocery chains. The implications of the latter development for increased competition in the fish trade may be neutralized by the forward integration of distributors with processors, although this is not known to extend beyond the wholesale level – and is by no means coextensive with the distributive trade in either the domestic or the export market. Backward integration, i.e. the control by distributors of sources of supply, is becoming an important factor in the market for the products of the freshwater fisheries but its effects have not been fully ascertained.

In part at least, the relative inflexibility of port prices is related to the close association of primary (catching and landing) and secondary (assembling and processing) operations. Markets are monopsonistic at many fishing ports, and at others primary-fishing enterprises often are linked to particular buyers through a service nexus, i.e. the advance of working capital and the provision of gear, fuel, ice, bait, etc. This extends in some cases – the Pacific

herring fishery, the Atlantic deep-sea fishery for ground fish and certain of the lake fisheries – to complete vertical integration (backward) of the primary and secondary phases of the industry. These developments are motivated by the desire to command financial resources for expansion, to diversify and stabilize raw-material supply (in the interests of fixed-cost reduction and market service), to control quality and promote brand families and so on. The fishermen's co-operative movement represents a parallel development, with similar objectives in part but differing perhaps in its effect on the organization of port markets.

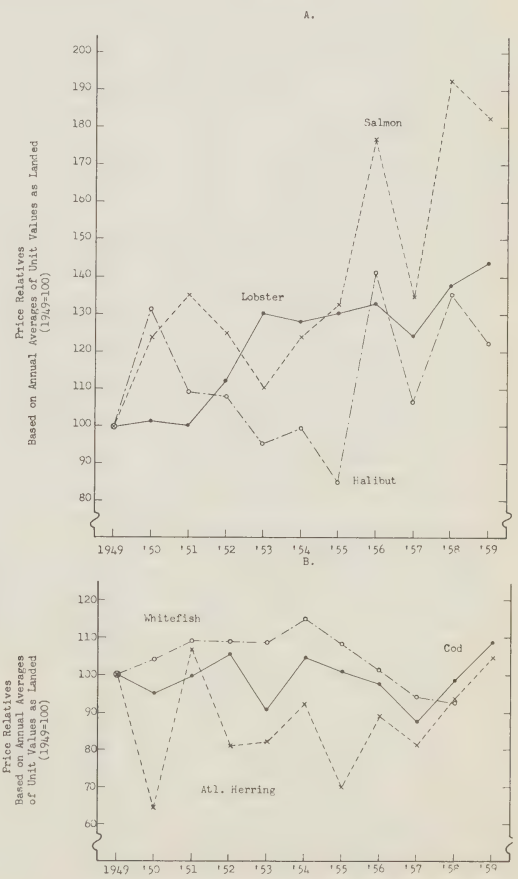
Other factors contributing to the tendency toward inertia in these markets are a) the widespread practice of quoting fish prices in cents per pound with quarter-cent intervals, which, in the case of the lower-priced species, precludes fine adjustment to demand-supply influences, and b) an apparently general disposition on the part of fishermen to favor stable prices. This propensity may be rooted rather in tradition than in considerations of business advantage, but stable prices do provide a fixed point in the complex of uncertainties (of weather and piscine behavior) with which fishermen have to cope.

Figure 10.



The social disadvantages that may stem from the imperfection of port markets in Canada become less serious over time. In the long run, the forces of demand are equilibrated with those of supply – in a fashion. Even in the case of cod landings, for example, statistical analysis of the historical series reveals significant responsiveness to the dockside price.[32] Over the period under survey here, as shown in Fig. 10, port prices have tended to rise faster than prices generally and faster than the retail prices for fishery products. It is evident also that, toward the end of the period, fishery prices were subject to influences beyond those tending to inflate prices generally. These influences may be identified with the demand supply factors described earlier as creating a quasi-luxury status for certain fishery products. As shown in Fig. 11, the trends for separate species support this view. In the first part of the figure are plotted the data for those species the supply of which is inelastic, in the second part the data for those – excepting whitefish[33] – with an elastic supply.

Figure 11.



A comparison, as in the following table, of trends in the price of these species with the trends for the products derived from them provides additional support. It is not possible to carry this analysis forward through the later stages of distribution, unfortunately – data for the purpose are available only at the manufactures' or first-wholesalers' level.

Accurate weighting of the product indices is not feasible with the price relatives used. With that qualification, the comparison indicates that, despite the various institutional rigidities present in our port markets, demand influences somehow are transmitted through the price structure.

Species	Index, 1958 Av. Landed Price (1949 = 100)	Principal Product Forms	Index, 1958 Product Price (1949 = 100)
Lobster	138.0	In shell	124.7
		Meat	156.3
Pacific Salmon (all spp.)	192.6	Dressed	152.5
		Canned	160.6
Pacific Halibut	136.0	Dressed	118.0
Pikeperch	188.0	Dressed	179.3
Cod	99.9	Filleted	107.3
		Cured	95.2
Atlantic Herring	94.2	Canned	108.9

Notes and References

[1] A simple formulation is as follows:

$Q = aR^b{}_p{}^c p d_e{}^{rt + u}$ or

$\log_e Q = \log_e a + b \log_e R + c \log_e p + d \log_e P + rt + u$

where Q symbolizes the demand for the product involved, R the (real) income of all consumers, p the price of the product and P an index of other prices; t represents time and u residual variations, and the parameters or constants a, b, c, d and r represent, respectively, scale, income elasticity, price and cross elasticities (a positive sign indicating substitutability and a negative sign complementarity) and the rate of change in trend. Cf. Stone, R., *The Role of Measurement in Economics*. Cambridge. 1951. p. 60 et seq.

[2] See, inter alia, Schultz, H., *The Theory and Measurement of Demand*. Chicago. 1939; Wold, H. and Juréen, L., *Demand Analysis: a Study in Econometrics*. Stockholm. 1953; Fox, K.A., *The Analysis of Demand for Farm Products*. Washington. 1953. passim.

[3] Cassady, R., "The Marketing of Fishery Products in the United States", in Turvey, R. and Wiseman, J. (Editors), *The Economics of Fisheries*. Rome. 1957. p. 200.

[4] With respect to food products, the familiar Engel's law.

[5] The Royal Commission on Price Spreads of Food Products, *Report*. Ottawa. 1959. Vol. II, p. 110.

[6] Ibid., p. 115; source D.B.S., *Apparent Per Capita Disappearance of Food in Canada*. Ottawa, annual.

[7] Cassady, R., *loc. cit.*, p. 199.

[8] Snaith, W.E., *The Marketing of Fish in Peterborough*. Ottawa. 1947; Van Vliet, W., *Regional Consumption of Fish in Canada*. Ottawa. 1948; Johnson, F.F., *Per Capita Consumption of Fish*. Washington. 1948; Popper, F. et al., *The Distribution of Fish in Toronto*. Ottawa. c. 1950 (unpublished); Stolting, W.H., Garfield, M.J. and Alexander, D.R., *Fish and Shellfish Preferences of Household Consumers*. Washington. 1955; Kahn, R.A. and Stolting, W.H., *Household Consumer Preferences for Breaded Shrimp and Breaded Fish Sticks*. Washington. 1955; Frick, H.C., "Urban Family Expenditures for Fish", *Trade News*. Ottawa. Jan. 1957; Stolting, W.H. et al., *Who Buys Canned Salmon, and Why?* and *Who Buys Canned Sardines, and Why?* Washington. 1960.

[9] Light consumers are defined as those consuming the product once or twice a month, and heavy consumers as those consuming it more often than that.

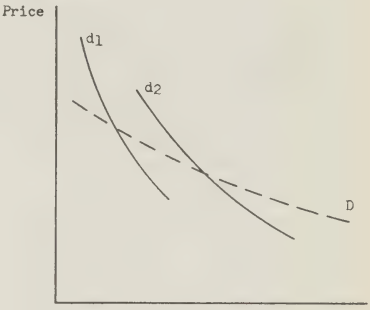
[10] Source: D.B.S., *Urban Family Food Expenditure, 1953, 1955* and *1957*. Ottawa. 1955-60.

[11] Cf. Katona, G., *Psychological Analysis of Economic Behaviour*. New York. 1951. pp. 67-68.

[12] See, e.g., those listed in footnote 3, and also Schrader, F.M., "The Demand for Meat in Canada", *Canadian Journal of Agricultural Economics*, Vol. 1, Spring 1953; Working, E.J., *Demand for Meat*. Chicago. 1954; Daly, R.F., *The long-run Demand for Farm Products*. Washington. 1956. Foote, R.J., *Price Elasticities of Demand for Nondurable Goods, with Emphasis on Food*. Washington. 1956.

[13] Cf., however, Göben, H., "Die Elastizitäten der Nachfrage nach Fischen und Fischwaren", in *Jaresbericht über die Deutsche Fischwirtschaft*, Bonn, 1959, where very high price elasticities are derived for fishery products.

[14] The manner in which short-term and long-term price elasticities may differ is illustrated in the accompanying diagram: the lines d_1 and d_2 representing, at different levels of average per capita consumption, the relationship in the short run between the price and the quantity consumed of a commodity and the line D representing the relationship between these factors in the long run. Short-term and long-term income elasticities may differ in an analogous manner.



[15] Cf. Turvey, R. and Wiseman, J., *op. cit.*, p. 209.

[16] The Royal Commission on Price Spreads of Food Products, *op. cit.*, Vol. II, p. 239.

[17] In this section, the writer has drawn heavily on the material prepared by J.N. Lewis and associates for the Royal Commission on Canada's Economic Prospects; see, RCCEP, *The Commercial Fisheries of Canada*. Ottawa. 1956. pp. 73 et seq.

[18] Cassady, R., *loc. cit.*, p. 198.

[19] Manipulation of supplies (and price) in this market might be expected to result from the extensive vertical integration of Canadian processing companies with distributors in the United States.

[20] FAO, *Food Supply, Time Series*. Rome. 1960.

[21] It is summarized in Gerhardsen, G.M., *Salted Cod and Related Species*. Washington. 1949.

[22] The pack is measured on the basis of a *standard* case containing 96 tins weighing one-half pound each, i.e. a case of 48 pounds.

[23] Typically, pink salmon serves as a base for casserole dishes and sockeye for salads and the like.

[24] The price relatives for sockeye are used as a type of salmon-price index here, in lieu of a weighted average of canned-salmon prices at retail. Quotations for the other species are unavailable before 1952.

[25] The definition of the resources available to the fishing industry in Canada – assumed in our judgments as to elasticity of supply – may appear to be arbitrary, when our fishermen are taking scallops from George's Bank (off the New England coast) and tuna off southern California, but a line has to be drawn somewhere. We are not unmindful either of the increasing numbers and efficiency of fishing craft from other countries on the Grand Bank and elsewhere in *Canadian* Waters, east and west.

[26] This trend is based on the quantities going into consumption annually, in domestic and foreign markets. Consumption is calculated from production, sales and inventory data.

[27] The double, single and broken lines represent the sources and direction of influence in descending order of importance.

Institutional factors, such as the vertical integration of primary and secondary operations and the organization of producers, are ignored in this scheme – as are also price supports, subsidies and the like. Among other simplification, a single end-use (product form) is assumed. Realistic description of the supply-demand structure would necessitate relaxation of this assumption. In nearly all instances, landings are utilized in several forms, i.e. not one but two or more simultaneously-determined demand equations are involved, and theoretical equilibrium requires that the prices obtained at the port be equal from all outlets. The pursuit of this and other refinements must be deferred for the present. A further assumption, viz. that production is not affected by the price during the marketing period, merits brief comment. It would appear to be a valid assumption generally, considering the inertia of investment and employment in fishing operations, but exceptional cases are conceivable and probably occur. Activity in the Atlantic halibut fishery, for example, is said to be determined by the ratio of halibut to cod prices.

[28] Cf. Bowen, I., "Port Markets", in Turvey, R. and Wiseman, J., *op. cit.* and Kühne, K., "Zur Ökonomie der Hochseefischerei", in *Wirtschaftsdienst Monatschrift*, Hamburg, June 1959. It is anticipated that the matter may be elucidated further in the forthcoming report by J.A. Crutchfield on the Pacific halibut fishery.

[29] The port-price data are plotted on a scale 2.5 times that used for the wholesale data, the yield from raw fish in the filleting process being 35-40 per cent for cod.

[30] Source: D.B.S.

[31] This series is based on the unit value of landings, i.e. a weighted average of all port prices obtained by dividing the total value of landings by the total volume. Since the *weights* are not constant, the highs and lows may be exaggerated to some extent.

[32] Gordon, H.S., "Economic Factors in Catch Fluctuations", *Journal of the Fisheries Research Board*, Vol. 12, No. 1. Ottawa. 1955.

[33] The anomolous position of whitefish is due, no doubt, to the replacement of diminishing supplies from nearby stocks with supplies from less accessible (and more heavily parasitized) stocks. The resulting charges for transportation and processing apparently offset the effect of demand forces on the price. Pikeperch, the trend for which is similar to those for salmon, etc., was omitted to avoid complicating the figure. Pacific herring, which would also have appeared in the first part of the figure, was omitted as not being affected directly by the requirements of the food market.

Productive Capacity of Canadian Fisheries—An Outline

W. E. Ricker
Fisheries Research Board of Canada, Nanaimo, B.C.

This paper is a condensation of parts of a comprehensive study by Dr. Ricker which the Resources for Tomorrow Conference will issue separately. Herein are the introduction to the longer paper, and, for the fish species of principal economic importance, statistics on recent landing, forecasts of landings in 1980, and brief comments on factors affecting future productivity. For much more information and a thorough understanding of the subject, the comprehensive paper should be consulted.

The future yield potential of a fishery is best estimated from the size of the landings and the percentage utilization of the stock, past and present, as these are related to the amount of fishing effort and to environmental conditions. Estimates of percentage utilization come from percentage recoveries of tagged fish, or from comparison of catch with escapement. Where no regular fishery exists, exploratory work can indicate the general extent of a stock, but it usually can give only a vague idea of the potential yield.

The actual size of a fish stock is a much less useful statistic than an estimate of its yield potential. Different fish stocks may be able to yield anywhere from about five per cent to possibly 200 per cent of their weight annually, depending mainly on the rate of growth and age at maturity of the fish. Yields of more than 100 per cent a year indicate that the stock is producing an annual surplus greater than its own bulk – something which is quite easy under tropical conditions, as every guppy fancier knows. In Canada's cool-temperature and subarctic climates potential yields are usually 50 per cent a year or less, sometimes much less. For example, commercial-size whitefish in cool Great Slave Lake increase in weight by 10-12 per cent a year, whereas in Lake Erie, with its warm water and much longer growing season, the weight increase is 30-40 per cent a year. The harvestable surplus produced by the two stocks is in much the same proportion. In general, the farther north you go, the smaller is the annual yield that can be expected from a fish stock of any given size.

Stock size can be a misleading guide to potential yield in another way. A stock of salmon, cod or any other fish decreases in abundance when man begins to use it, and its adult fish must remain less numerous as long as an annual crop is removed. For long-lived fish, the original period of *fishing-up the accumulated stock* may extend over quite a few years. and it is a time of better fishing and larger catches than can ever be obtained again. It is like the harvest of trees from a virgin forest – there is a big initial yield of mature timber, after which the annual sustained yield from yearly growth will be much less. For example, some of the northern redfish stocks of the west Atlantic are today in this early phase of utilization, and are yielding catches which cannot be maintained for more than a few years. For them it is necessary to predict much smaller yields 20 years from now. By contrast, stocks that have long been fished are likely to have come to equilibrium and will continue to produce at least at the present rate.

For some of our stocks the rate of capture of the fish in sight is high, 50 per cent a year or more, because it is only the mature part of the population that is available for catching. This is true of the Pacific herring fishery and most salmon fisheries.

Without fishing, a fish stock becomes so dense that growth is slow and mortality is great, especially among eggs and young; growth and reproduction suffice only to compensate for natural losses, and there is no net surplus. This is true in cold water or in warm, regardless of how large the potential surplus production may be. A fishery, by reducing the density of the stock, creates the conditions necessary for production of a surplus that can be harvested annually. Removal of most of the large old fish may increase the net rate of reproduction, increase the rate of growth, and decrease the average rate of nat-

ural deaths in the stock – all of which increase the net surplus product. Of course, if a stock is reduced too much, eventually the annual production of a usable surplus must decline. Somewhere in between there is a level of fishing, at which the *maximum sustained yield* will be obtained.

Thus there are two fundamental rules of fishery management:

(a) If a stock is being used to less than capacity by reason of underfishing, more fishing will increase the sustained yield and at the same time decrease the size of the stock (or of the spawning stock, at least).

(b) If a stock is being used to less than capacity because of overfishing, less fishing will increase the sustained yield and at the same time increase the size of the stock.

It turns out that for many of our fisheries we must anticipate a trend which superficially seems paradoxical: in future a greater catch will be taken from a smaller stock. Consequently, in what follows usually only the estimate of future catch is given, not the stock size.

The above rules define underfishing and overfishing in biological, not economic terms. After exploitation of a fish stock passes the very early exploratory stage, increase in effort always gives a less-than-proportional increase in yield – that is, catch per unit of fishing effort falls off steadily, even while there is still no sign of biological overfishing. In some fisheries it is impossible, from an economic point of view, to increase fishing to the point of maximum sustained yield, because monetary returns per unit cost would fall too low. In that event, increased catch in future might arise from use of more economical gear, improved handling, new uses for the product, greater consumer demand, etc., which would be reflected in greater landings per fisherman or an increase in landed value per pound. Equally, a less favourable economic climate can reduce a fishery: salt cod and herring meal are examples of products that have recently become more difficult to market.

On the other hand, for a preferred species, fishing can easily become intensive enough to reduce the annual yield much below the sustainable maximum, without reducing the profitability of the fishery below what is economically bearable.[2] In that event obtaining the maximum sustained yield becomes possible only with some kind of legal restriction on the amount of fishing done: for example, by closures, size-limits, quotas, or restricted licensing. All these measures except the last are used to maintain the catch of the Pacific salmons, halibut and herring, and all are widely used in regulating freshwater fisheries. Granting of leases or property rights has been done in the case of some shellfish, where maximum yield is possibly only a *farming* basis and the individual can profit in proportion to his own efforts.

Rules of fishery management given above defined the eventual, or equilibrium, effect of increasing or decreasing fishing. The immediate effect may be different. Increasing fishing always means a greater catch in the current year. Less fishing always decreases the current year's catch. These short-term effects tend to obscure the over-all picture. For example, often an increase in fishing effort will give an immediate increase in catch sufficient to more than pay its cost, but after two or three years the catch – though perhaps will larger than it was originally – may fall to an equilibrium level that is uneconomic for that amount of fishing. Scarcely less painful is the situation where investigation has shown that less fishing will eventually increase the yield, yet this increase can be realized only by reducing effort and, temporarily, catch as well. For our prediction of future yields, however, we assume that such transition periods will have been passed successfully.

Variations in climate are an important cause of change in size of fish stocks, hence of catch. Warming of the water along any coast permits establishment or increase of warm-water species, and causes a decrease in abundance and retreat northward of cold-water species. Consequently the long-term prospects of some fisheries depend on the ocean temperatures which will prevail 10, 20 or 50 years from now.

No secure prediction can be made of the direction of climatic change. On the Atlantic coast there is some indication that the sea has begun to cool from the unprecedented high levels of the 1950's. This would benefit cool-water species like cod and salmon, while summer visitors like tuna and swordfish would not come north as far or in as great numbers. On the Pacific coast no basis for prediction is available, but in the past 10 years water temperatures have risen a little, after having fallen sharply from 1940 to 1950.

In addition to natural changes in environment, manmade modification must be taken into account. Our anadromous fishes have been most susceptible to damage, and even where the physical cause is removed, it may be many years before stocks are restored to the size which gives maximum yield. In such instances predictions must take into account the future maximum yield and the rate at which it can be achieved. Less spectacular environmental changes due to logging, pollution, etc., have been considered as far as possible.

Not all changes are harmful. For example, domestic sewage, suitably handled, qualifies as a fertilizer and can increase fish stocks in fresh waters.

Man can also sometimes increase fish stocks by direct aids to production. For example, fishways surmounting natural obstacles, improvement of natural spawning facilities, artificial propagation, predator control, etc., will likely play increasing roles in future.[3]

One of the greatest unknowns is the extent to which increasing demand, combined with research, enterprise and ingenuity will bring new fisheries into being. The rapid increase in population now taking place the world over cannot fail to produce a long-term increase in the demand for fish. Evidence of the effects of population on exploitation of fishery resources may be seen in the much larger landings made from European and Asiatic waters, than are made in North American waters of comparable extent. Recent decades provide several examples of previously unused fish becoming the basis of large industries – for example, the Atlantic redfish, the Pacific cod in British Columbia, and the smelt in the Great Lakes. The importance and timing of such advances are, however, impossible to predict with any confidence. They involve stocks about which little is now known, and usually also some break-through in technology, such as in the case of *fish-sticks*, or else some major shift in economic trends. Beyond pointing to some of the currently unused stocks, we are unable to predict what may be very important contributions to our fisheries by 1980.

Another variable in the extent to which foreign participation in fisheries that interest Canada may affect our landings. The present trend is toward rapidly increasing competition in some areas, and potential threats elsewhere.

With the preceding considerations in mind, potential landings in 1980 of the species of major importance have been forecast. They are presented below along with average annual landings for the period 1951-55 (except in the case of the Pacific salmons, for which the base period 1951-54 is used). Landings are in millions of pounds round fresh weight, except as indicated.[5]

	Present (average for 1951-55)	Potential 1980
Atlantic Fisheries		
Cod	752	850
Haddock	107	120
Redfish	44	45
Atl. Halibut	7	6.5
Flounders (4 spp)	68	100
Herring	245	350
Mackerel	29.7	40
Lobster	47.7	48
Scallop	1.5	8 - million lbs. of muscle
Oysters	6.5	15 million lbs. (shell incl)
Clams (3 spp.)	13.7	12
Pacific Fisheries		
Sockeye Salmon	35.8	74-109
Pink "	49.6	100-130
Chum "	56	80
Coho "	22.7	27 - mixed wts.
Chinook "	12.4	13.5 - mixed wts.
Pac. herring	360	520
Pac. Halibut	61.4	75
Soles (5 spp)	9.1	24
Crabs	3.3	6
Oysters	6	24 million lbs. (shell incl)
Clams (3 spp)	4.6	5
Freshwater Fisheries		
Lake Whitefish	25.3	36
Lake Trout	6.1	6.4

Atlantic Fisheries[4]

Cod

The cod supports fisheries from Cape Cod to southern Greenland. It is the most abundant of the west Atlantic commercial groundfishes. Best catches are made where bottom temperatures range from 32° to 40°F.

The cod fishery of the Newfoundland and Labrador area is the oldest non-indigenous fishery in America. From the time of the earliest settlement of Newfoundland, cod fishing has been a major industry, originally *the* major industry. By 1800's there was already a fairly large production (about 300 million pounds, round fresh basis). This rose to about 700 million pounds during World War I, but since World War II it has declined to between half and two-thirds that figure (Fig. 1). There has always been some fishing by European countries in the Newfoundland region, and this has increased rapidly in the last 15 years. To-day foreign vessels take more than half of the catch, and their fleets continue to expand rapidly.

The decrease in the over-all Canadian cod catch has been largely a reflection of the contraction of the salt cod industry. Fresh fish production has increased, but not as rapidly as salt fish production has declined.

Stocks in the waters off Newfoundland and Labrador are probably still only moderately exploited, though this may change rapidly.

For the future, it appears that the production of salt cod, and particularly of light salted cod, will continue to decline. Production of fresh cod, and of

salt cod dried with the help of mechanical driers, is expected to increase. During the next 20 years the latter trend may well overtake the former, so that Canadian landings of 600 million pounds in 1980 do not seem unreasonable. This could be achieved even with some increase in European competition. However, there is real danger that European fishing effort may soon so outweigh Canada's that our catch may decline because of scarcity of fish as well as of markets.

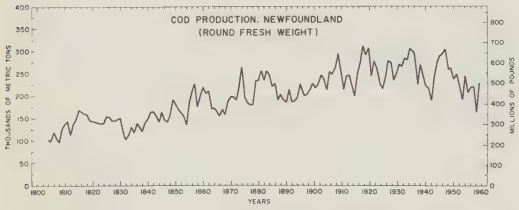


Fig. 1. Rise and decline of the Newfoundland cod fishery, based on exports to 1929, and total landings since that time.

Waters of the Gulf of St. Lawrence and southward are fished more intensively than those of Newfoundland, but this is compensated to some extent by the greater rate of growth of the fish. The present level of catch is being maintained partly by *fishing up* of the older stock, with the result that the fish taken have become smaller and will become smaller yet. The present rate of utilization, about 40 per cent a year, is believed to be close to the figure which will provide maximum sustained yield. The more than 600 million pounds removed in 1959 is considerably more than can be taken on a sustained basis.

For the future, Canada may be expected to take about 250 million pounds a year by 1980 if foreign competition levels off at a somewhat lower figure than in 1959; otherwise a decline in our landings must be expected, to possibly 200 million pounds or less a year.

Thus total Canadian landings of cod from all waters fished by Canadians may approximate 850 million pounds in 1980.

Haddock

The haddock occupies somewhat warmer waters than cod, though their ranges overlap broadly. The waters immediately south and southeast of Newfoundland contain haddock in enormous numbers in some years. Occasional rich year-classes populate the southern Grand Bank or St. Pierre Bank and support a good fishery for three or four years at a time, but gaps occur – sometimes fairly protracted ones.

Basically, the quantities of haddock which may be expected 20 years hence will be determined by the strength of year-classes at that time, which in turn will depend at least partly on temperature conditions. An estimated total take of 180 million pounds in 1980 presupposes that conditions for reproduction are still favorable and that foreign competition does not greatly increase.

Redfish

Commercial fishing for redfish occurs from the New England Banks to Northern Labrador. The bulk of our stocks are of the deep-water *mentella* type, which prefers deep waters with temperatures ranging from 35° to 50° F.

On most redfish banks the removal of accumulated stock of old fish is still in progress, so that it is difficult to estimate what the sustainable yield will prove to be. It is unlikely that the present rate of yield of redfish can be maintained as the accumulated stocks are removed. On some of the longer-fished portions of the eastern and southwestern Grand Bank, the redfish has already become much scarcer and smaller in size than originally.

An estimate of future sustained yield is 50 million pounds.

Atlantic Halibut

Though not a major species in poundage landed, good price and good demand make this an important fish.

Recently European vessels fishing specifically for halibut have made good catches off Newfoundland, in competition with Canadian longliners. The Canadian effort may decline gradually as the dory schooners now fishing halibut become obsolete, so future landings are set a little lower than those of the present.

The Flounders

Four species of flounders are of economic importance in the Atlantic region.

Much the largest contributor to the catches is the American plaice, for which the northern and eastern edges of the Grand Bank are important fishing areas. The stock appears to be large, and so far the foreign fleets have not taken much interest in it.

Greysole or witch has provided up to 12 million pounds. The winter flounder is taken mainly along the Nova Scotia coast, and the yield probably will never exceed one million pounds. The yellowtail flounder is an offshore species and has accounted for possibly three million pounds.

Herring (includes sardines)

Herring fishing has a long history in Canada, and it is potentially the greatest single Atlantic fishery. Pr-

esent fishing probably does not take more than five to seven per cent of the stock per year, and this could at least be doubled. Even in the *sardine* fishery of the southwestern Bay of Fundy, which is based on small herring, surveys indicate a stock much greater than present landings. Much herring is used for producing fish meal and pet food, and these uses will continue.

Mackerel

The mackerel is a pelagic fish that winters along the edge of the Gulf Stream and moves north to our waters in variable numbers in summer. The greatest catch of record was 70 million pounds in 1880.

The postwar average of about 30 million pounds is less than the present potential. The principal obstacle to greater utilization is the rapid oxidation of fats in the body, which changes a very tasty fish into a much less palatable one in a short space of time. The parallel problem with tuna is solved by cooking out the natural oil, but no economic treatment mackerel has been developed.

Lobster

The lobster fishery is very intensive. In Canadian mainland areas annual yields were about 80 million pounds during the period 1881-95, and subsequently fell to the present levels which have been maintained with some variations since World War I. The earlier, larger yields represented mainly the removal of the accumulation of large old lobsters on successive grounds, and cannot be expected to recur. At present the intensive fishery takes about two-thirds of the legal-sized stock each year. Slightly warmer temperatures might increase production to about 55 million-pounds on the mainland and five million in Newfoundland, but with the predicted cooling even intensive management will scarcely provide catches greater than 48 million pounds.

Scallop

The scallop is taken in some quantity off western Newfoundland, on St. Pierre Bank, and in the Bay of Fundy areas which produce about a million pounds of meats a year. A future average yield of eight million pounds is possible, mainly from George Bank; but the stocks fluctuate and the immediate prospect is for some decrease in landings.

Oysters and Clams

The production of oysters in eastern Canada is limited to the southern Gulf of St. Lawrence and Cape Breton areas. The decline in production during the 1950's resulted mainly from a disease attacking Nova Scotia and New Brunswick stocks. The establishment of stocks resistant to the disease is proceeding, but will take some years yet. The larger future landings are based on more intensive oyster culture, which will be made possible by development of more reliable sources of large quantities of seed oysters.

The most available stocks of soft-shell clam passed through the *fishing-up* phase during the period 1946-55, and are now settling down to the smaller harvest of the annual production. Improved harvesting methods and utilization of additional stocks may permit a five million pound yield by 1980.

The decline of the soft-shells has encouraged utilization of other clams, of which the quahaug shows most promise, though it is currently affected by unusual mortality in important areas. The bar clam may have a two million pound potential. Large stocks of ocean quahaug will be difficult to harvest and market.

Pacific Fisheries

Sockeye Salmon

The sockeye salmon matures mainly in its fourth year in southern British Columbia, and in either the fourth or fifth in the central and northern regions. It averages about seven pounds in weight, and is the most valuable of the three abundant salmons. It typically spends one growing season in a lake, followed by three or four in the sea.

In most but not all nursery areas numbers of sockeye show great variation from year to year. In some Fraser River stocks this takes the form of a very marked preponderance of one of the four lines or cycles, so that fish spawned in *off* years are almost negligible. Up to 1913 a great majority of this river's stocks matured dominantly in the 1901 line. However, rock slides at Hell's Gate in 1913 and 1914 almost wiped out the dominant line and its successor. Complete loss was avoided by removal of much of the rock at the time, and in 1945-46 the International Pacific Salmon Fisheries Commission completed fishways to provide easy access at this point. Today there are fairly large stocks in three of the four lines, but the largest single stock matures in the 1902 line (Fig. 2).

The future sustained yield of Fraser River stocks can be estimated in two ways.

(1) The maximum four-year-average yield of the past was one million, 26 thousand cases in 1899-1902, or about 80 million pounds. The smaller lines at that time were probably fished adequately or even overfished, but the big 1901 line was not then harvested to its full potential. Thus 80 million pounds is a possible minimum estimate of sustained yield, 40 million pounds of which, by international agreement, would go to Canada.

(2) The one important upriver region that may today be near maximum yield is Shuswap Lake (area

129 square miles, including Little Shuswap) – home of the Adams River run and other smaller runs. Its average yield to the fishery in 1951-58 was close to 20 million pounds a year, or 155 thousand pounds a square mile. Applying this rate of yield to the total upriver lake area of the Fraser (850 square miles), and adding three million pounds for the less productive downriver lakes, an estimate of potential yield for the whole system is 134 million pounds a year – of which 67 million pounds would be caught by Canada. This is a larger figure than the 40 million-pound minimum above, but it is not necessarily the maximum possible. It is not known whether Shuswap Lake – the basis of estimation – has yet reached its maximum productivity, because several of its former spawning streams still lack sockeye, and several lakes are known to produce more sockeye per square mile. Also, management measures may increase the production of the downriver lakes.

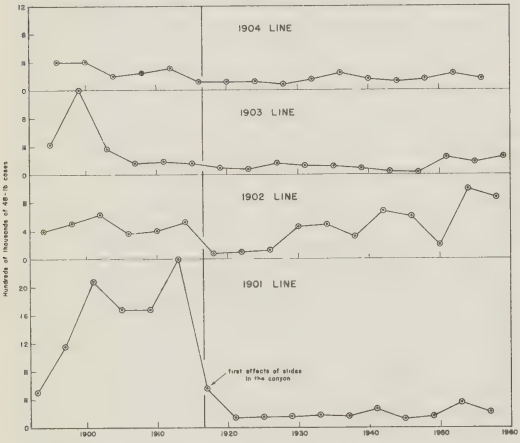


Fig. 2. Pack of canned sockeye from the Fraser River, Puget Sound and adjacent waters, 1892-1959. A 48-pound case recently has corresponded to 70 pounds of fresh sockeye; in early years it was probably closer to 80 pounds. Data from Rounsefell and Kelez (1940) and Reports of the International Pacific Salmon Fisheries Commission.

The Smith Inlet and Rivers Inlet stocks have remained rather consistently at a high level of productivity (yields of about 250 thousand pounds a square mile of lake) for many years, and they may be expected to maintain this.

On the Skeena River in recent years the catch has been restricted so as to overcome the effects of a rock slide that affected the 1951 and 1952 runs, and to obtain a better distribution of spawners in Babine Lake. The best four-year average annual take on record was eight and one-half million pounds, but even this is not a really large yield in terms of lake area: about 40 thousand pounds a square mile. Most of the Skeena sockeye are reared in Babine Lake, where the main body of the lake is so remote from the best spawning grounds that it is understocked and apparently has always been so. Large-scale fish-cultural measures may be required to bring the lake up to its potential production based on food available. If this can be done, an average yield of 15 million pounds seems reasonable; while if it equalled Shuswap's present performance there would be over 25 million pounds.

The Nass River's two rather small remote cold lakes may be capable of producing no more than at present (about two million pounds), though there is no really good assessment of their capabilities. Other sockeye areas are estimated to be able to produce seven million pounds, little more than at present. Many of these lakes are in regions having insoluble rocks and are very low in nutrients.

Pink Salmon

The pink salmon matures in its second year of life; it averages five pounds in southern British Columbia, and about four pounds in the north. In southern British Columbia the Fraser River and immediately neighboring streams have abundant runs in odd-numbered years, and very few pinks in even years. This shows up in the catches for the Fraser area, and to some extent also in Johnstone Strait. In most Queen Charlotte Island streams the even years are large, the odd years blank or nearly so. In most other regions there is no consistent superiority of one year or the other.

Prospects for increased yields in future stem from a number of sources:

(1) Pink salmon of the Fraser River, lower Strait of Georgia, Puget Sound and Strait of Juan de Fuca were brought under international management in 1957; the great majority of these stocks are hatched in Canada, mostly in the Fraser watershed. The agreement provides for equal sharing of the catches in Convention waters between Canada and the United States. Thus if the Fraser and associated stocks are brought back to the rather steady level of yield of 1925-31 (about 56 million pounds taken each odd-numbered year by the two countries together in this region) Canada will automatically have an increased catch; during the years mentioned Canada never took more than 15 per cent of the combined catch in the present Convention waters.

(2) All upriver runs of pink salmon to the Fraser River were destroyed by the Hell's Gate obstruction in 1913.

After the Hell's Gate fishways were built in 1945-46, pinks soon appeared in various spawning tributaries above it. Assuming the upstream runs become re-established and the lower-river runs can be increased to full productivity, the average odd-year catch will be 112 million pounds. The portion taken in Convention waters will be divided 50-50 between Canada and the United States. However, some of the Fraser pinks are taken by Canada north of Convention waters so that we will be able to harvest more than half -- say 66 million pounds or 33 million pounds a year -- as compared with about 10 million pounds a year at present.

(3) In the past 10 years, particularly, many spawning grounds along the coast have received fewer spawners than they could accommodate efficiently. Measures to increase escapement will mean smaller catches temporarily, but will be followed by much larger catches in the long run.

(4) Expanded fish-cultural activity, by providing new spawning areas, improving old ones by control of water flow, opening spawning grounds above impassable falls, and possibly by hatchery operations, are expected to add considerably to pink stocks in the years ahead.

(5) A special opportunity lies in the possibility of establishing runs in *off* years of the Fraser region and Queen Charlotte Islands. Because of past failures, no prediction of success can be made, but the potential is very great: doubling the yields otherwise estimated in the areas concerned.

Against the above prospects must be set the negative factor of (probable) increase in diversions of water to other uses. So far, pink salmon have not been seriously affected by power developments.

On balance we may reasonably expect a sustained yield of pink salmon of 100 million pounds by 1980, and it could be greater.

Chum Salmon

The chum salmon resembles the pink in requiring little or no food during its freshwater period of life. It does not, in British Columbia, range as far up the large rivers as the pink does. The chum usually matures in its third to fifth year, and averages about twelve pounds in weight.

Increasingly precise management should make it possible to re-establish an adequate spawning stock wherever it is needed, and this is the principal basis for estimating increased catches in future. Chums may also benefit from fish-cultural activity, but it is likely that the more valuable pinks will be given first consideration in planning such measures.

For the long run, after restoration of adequate spawning stocks we anticipate an average yearly catch of about 80 million pounds, which is about 20 million pounds more than the 1946-54 average (discounting the effect of the 1952 strike). However, a larger yield than this is a real possibility.

Coho Salmon

The coho salmon inhabits many small streams as well as larger rivers. It lives for a year in fresh water, then goes to sea for one or two growing seasons, rarely more. Most of them mature in their third year, and these provide the commercial catch. Fishing is mainly by trolling, with some taken in seines and gill nets.

Of all the salmon, the coho is most susceptible to damage from encroaching civilization and industrialization, because almost any alternative use of water, from even the smallest streams, worsens or destroys a portion of its habitat. Such uses are almost certain to encroach further, but will be to some extent offset by increased fish-cultural activity, opening of inaccessible rivers, etc. Additional gains may be possible by concentrating the fishing later in the year, because the fish grows rapidly during its final year of life -- much more rapidly than it is likely to die off from natural causes at that time. For these reasons a small increase in landings is predicted by 1980: to 30 million pounds in the commercial catch and two million pounds taken by sport fishermen. These expectations could be cancelled, however, by the damming of one or more major coho rivers, or by any widespread use of DDT in coastal forests.

Chinook Salmon

(Includes red and white springs and jack springs)

The chinook salmon is mainly restricted to rivers of moderate to large size, and ascends these to the limit of unobstructed passage. It typically goes to sea during the summer or early autumn of its first year, but sometimes a year later. Returning adults with one full year of sea growth are called jack springs, and are large enough to be taken in nets or by trolling. Older fish range up to 60 pounds and more.

Like those of the coho, spring salmon catches have been rather steady since 1945, and there is no indication that prewar catches were ever any greater. However the recent trend is slightly downward, and the fish taken today are much smaller in average size than those of the 1920's. The catch has been maintained as well as it has only by a considerable intensification of fishing effort, accompanied by decreasing catches per boat. Present decreased abundance can be described mainly to the gradual but cumulatively disastrous decline of the Columbia River stocks over 25 years or longer; these stocks had contributed importantly to the troll fishery in outside waters. There has also been considerable deterioration or elimination of runs in various smaller rivers of tr-

ibutaries – in Canada, the Nechako River and Bridge River may be mentioned.

For the future, the best management is unlikely to do much more than maintain the present yield of this species. The estimate of a 15 million-pound commercial catch and two million-pound sport catch in 1980 presupposes that some of the more remote stocks can support somewhat more intensive utilization, that no dams will be built on major rivers, and that any future derioration of some habitats will be compensated for by improvements in others, or by new stocks maintained by artificial rearing.

Pacific Herring

The herring supports the largest British Columbia fishery in tonnage landed. During the postwar period annual landings have been between 150 thousand and 250 thousand tons, except in two seasons when operations were restricted for economic reasons (1952-53 and 1957-58).

Assuming that market demand permits continued processing by reduction, some expansion of utilization, particularly of the Queen Charlotte Islands stocks, may permit an average yield of about 520 million pounds in years ahead.

Pacific Halibut

For many years the Pacific halibut has been under the management of the International Pacific Halibut Commission, established by treaty between the United States and Canada. The Commission's Area 2 extends from central Washington to Cape Spencer in Alaska, including the whole of the British Columbia coast and most of southeastern Alaska. Area 3 extends west from Cape Spencer, and includes the Bering Sea.

The principal feature of management policy is a limit on the catch taken each year from each area, supplemented by adjustment of fishing seasons in special regions. This policy, begun in 1932, has been accompanied by a marked increase in abundance of the fish.

For Area 2, the future sustained yield estimate of 35 million pounds may be a little low, but there is no secure basis for postulating a larger amount. Canada's share is estimated at 20 million pounds, a little more than half the total, because the most productive banks lie off the British Columbia coast. The future yield estimate of 40 million pounds for Area 3 includes that from newly-exploited banks in the Bering Sea. Canada's share is set at about its present percentage, and comes to 17 million pounds.

Flatfishes Other Than Halibut

Up to several million pounds each of several species of flatfishes are taken by trawling along the British Columbia coast. They are important in the local fresh fish market. One species, the petrale sole, congregates in dense masses in winter and may have suffered overutilization as a result, but the fishery developed recently enough that the potential sustained yield is not yet known. Other species are not yet exploited to capacity, except possibly certain stocks near Vancouver.

Future catches estimated for the various species are mostly somewhat greater than those being taken at present. Realization of these goals presupposes a greater market demand than now exists.

Crabs

The crab is taken almost wholly in traps, the northeastern Queen Charlotte Islands region being a big producer. From 1950 to 1954 United States trawlers took half or more of the yield from this district, reaching a peak of one million, 400 thousand pounds in 1953, but since that time their take has declined and it is now quite small. Our increased landings and improved competitive position reflect a steady growth of the crab fleet. Although crabs are intensively fished in many places, a size limit protects a majority of females and there has been no evidence of decreased recruitement. Some stocks can support heavier landings than today, and the 1980 take is set at six million pounds.

Oysters and Clams

Only the Pacific or Japanese oyster is used commercially, and nearly all production is from leased lands. Production has been steady since 1950. Much larger yields, up to 500 thousand gallons, would be possible from oyster lands if they were more adequately seeded and harvested. The postulated yield of 300 thousand gallons in 1980 presupposes greater demand than exists at present.

All clams are harvested from wild stocks. Butter clams give the biggest yield; all important beds are being harvested, and no increase of production is in sight. Little-neck clams of two species have declined in utilization recently. Harvesting of razor clams is limited by weather and availability of diggers. Larger supplies are available. If mechanical harvesting can be developed successfully, yields much larger than the above may be possible.

Freshwater Fisheries

Lake Whitefish

The opening up of additional northern lakes is the principal basis for predicting a yield increase. It is difficult to forecast the Great Lakes production. The whitefish is attacked by sea lampreys to some extent, but there is no evidence that they have done any appreciable damage to whitefish stocks; in fact, the

appearance of sea lampreys in Georgian Bay was followed by a remarkable increase in whitefish catches. Past levels of sustained landings suggest that four or five million pounds would be a reasonable Canadian yield from the Great Lakes under favorable conditions.

Lake Trout

Increased yields are predicted on the opening up of more northern lakes to fishing, and possibly a somewhat greater yield from Great Slave Lake. The lake trout of the Great Lakes are now at a very low ebb, their decline in the upper lakes having been caused, or at, least greatly accelerated, by the invasion of the sea lamprey in the 1930's. Past periods of fairly uniform landings in the various lakes suggests a potential Canadian sustained yield of five or six million pounds from the Great Lakes, whereas today only western Lake Superior still provides a fair catch. The Great Lakes Fishery Commission is conducting an all-out campaign to control the sea lamprey. If this is successful, the basis for the return of the trout fishery will be laid, but because of slow growth it is unlikely that any large quantities will be landed by 1980. The trout of Lake Ontario, where the lamprey is not a newcomer, have also declined almost to zero in the past 25 years, and it may be that the nets used for pickerel, ciscoes, etc., do not permit survival of sufficient young trout to maintain a population. Consequently no prediction of the restoration of the Great Lakes commercial trout fishery can be made at this time.

Notes and References

[1] This paper incorporates the work of several people employed by the Fisheries Research Board of Canada, the Canada Department of Fisheries and the various departments of provincial government concerned with commercial fisheries. In part, it draws on the biological information assembled in the preparation of *The Commercial Fisheries of Canada*, one of the publications of the Royal Commission on Canada's Economic Prospects (1957).

[2] See paper on *Role of Fisheries in the Canadian Economy*, prepared by J.A. Crutchfield for the 1961 Resources For Tomorrow Conference.

[3] See paper on *Effect of Man-Made Changes in the Environment of Fishes*, prepared by P.A. Larkin for the 1961 Resources For Tomorrow Conference.

[4] For information on salmon see paper on *Management of Atlantic Salmon*, prepared by C.J. Kerswill for the Resources For Tomorrow Conference, 1961.

[5] Catch statistics are taken mainly from the following publications;

Fisheries Statistics of Canada. Issued annually.

Statistical Basebooks, Markets and Economic Service, Canada Department of Fisheries. (No. 2 – Great Lakes fisheries; No. 3 – British Columbia salmon fisheries.)

British Columbia Catch Statistics, Canada Department of Fisheries, Pacific Area, Vancouver. Issued annually since 1951.

Statistics on Salmon Sport Fishing in the Tidal Waters of British Columbia. Canada Department of Fisheries, Pacific Area, Vancouver. Issued annually since 1959 (starting with the 1953 season).

Statistical Bulletin of the International Commission for the Northwest Atlantic Fisheries. Issued annually since 1951.

Statistical Yearbook of the International North Pacific Fisheries Commission. Issued annually since 1958.

Fisheries Research Board of Canada Biological Station, St. Andrews, N.B., Circulars, *Statistical Series.* Issued irregularly.

Report and Supplement, International Board of Inquiry for the Great Lakes Fisheries. U.S. Government Printing Office, Washington, 1943.

Annual Reports of the following Departments and Commissions; British Columbia Department of Fisheries, Alberta Department of Lands and Forests, Saskatchewan Department of Natural Resources, Manitoba Department of Mines and Natural Resources, Ontario Department of Lands and Forests, Quebec Department of Fish and Game, International Pacific Halibut Commission, Seatle, International Pacific Salmon Fisheries Commission, New Westminister.

The Effect of Man-Made Changes on the Environment of Fisheries

P. A. Larkin,
Director,
Institute of Fisheries,
University of British Columbia

Man's activities can affect environments of fishes in many ways. It is convenient to classify these effects biologically rather than to catalogue the various kinds of human activity. In general, effects can be measured by consideration of (1) factors influencing basic aquatic productivity, (2) the requirements of aquatic organisms, and (3) the requirements of fish populations. Each of these considerations involves a large body of specialized research information as well as detailed investigation of highly local conditions.

Constructive improvement of the physical environment of fishes has been attempted by creation of bodies of water, regulation of stream flows, elimination of natural obstructions, and lake fertilization. Control of undesirable species has recently been emphasized with the development of efficient chemical eradicants, supplemented by electric fishing devices. Culture of desirable species of fish for wholesale planting from hatcheries into the wild has proven unsatisfactory in many instances and has been largely replaced by hatchery devices for solving highly specific fish cultural problems for which an adequate research background has proved the need.

Development of resources other than fisheries can have profound effects on fish and their environment. Pollution of lakes and streams is a growing problem in the more urban areas of Canada and pollution control is beset with a variety of biological and administrative complexities. A national conference on pollution is recommended.

Problems posed by construction of dams or lakes and rivers have been regionally important in recent years. Except for large dams on rivers with large runs of fish, the present technological information is adequate for development of compromises which preserve a sufficient proportion of fish production without undermining the economics of the dam construction.

Good land use practice is in general associated with proper protection of water resources. Soil erosion caused by agricultural abuses or excessive logging is detrimental to fish production. Improvements in land use practices have resulted in benefits to fisheries.

There have been some isolated instances of marine pollution and obstruction which have underlined the need for oceanographic investigation.

The satisfactory resolution of resource use conflicts involving fisheries requires both federal and provincial legislation and supervision. The federal statutes are broad and effective, but to plan resource development properly and to avoid unnecessary conflicts it is desirable that provinces have some agency which represents the fisheries resource. This is particularly important in the coastal areas. A substantial body of technical information is necessary to provide adequate protection of fisheries at the local level. Provincial staffs of technical personnel should be increased.

To date, Canada has successfully handled the problems for fisheries involved in the development of natural resources. The next few decades may be decisive in determining whether this favorable trend will be continued into the indefinite future.

A great many of the activities of man may modify the aquatic environment and influence the production of stocks of fishes. The natural circulation of water is intimately associated with plant cover – one of the first features of a countryside to be modified in development. Water is required by man, his animals and crops, his industries and for his power. Accordingly, many of his activities must inevitably but unintentionally influence environments for aquatic organisms. Moreover, man has a direct interest in harvesting a crop from the water, and may undertake to improve on natural production. Thus a great many of man's activities may have effects on aquatic environments.

To classify these effects solely on the basis of the human activity responsible poses formidable problems of achieving completeness, and could suffer from the

93452–52

need for new categories as the spectrum of activities is enlarged with future technology. Fortunately there is another avenue for classification. Characteristically, the total production of organisms per unit time (or gross productivity) usually shows a relative stability, reflecting the influence of rather few major features of the environment. Similarly, the requirements for life of aquatic organisms as a whole can be broadly classified quite simply. Finally, the requirements of fish populations, although highly specific, fall naturally into a few categories. As a preface to discussion of the effects of various activities of man, there follows a broad statement of principles in aquatic biology, from which specific effects can usually be inferred.

There being rather few isolated instances of man's activities influencing marine environments, the discussion is centered on freshwater.

Types of Effects of Man's Activities

Productivity in aquatic environments

Four groups of factors are instrumental in determining levels of gross productivity in lakes and streams (28, 21). First of these are the *edaphic* or *soil* factors. Greater quantities of dissolved minerals and suspended organic matter are associated with higher levels of productivity. For this reason alone, productivity in waters of the Canadian Shield and in small alpine drainages is relatively low. Supplementing natural inflow of nutrients with organic and inorganic fertilizers (whether by design or unintentionally from land fertilization or sewage disposal) usually results in increased productivity. However, fertilizers in excess can cause changes of water chemistry with a reduction in the abundance of desirable organisms. Similarly, though leaching of soil minerals is a natural process of water fertilization, excessive soil erosion and the transport of large quantities of coarse suspended material are detrimental – limiting light penetration in water, smothering organisms, and scouring stream bottoms. In general, good land husbandry is associated with high aquatic productivity. The moderate use of water systems as sewers for organic wastes is also favorable to gross productivity, although it may limit production of desirable species, and may violate both public health and esthetic standards.

The second group of factors influencing gross productivity consists of those summarized under the heading *morphometric factors* – all the physical dimensions of the aquatic environment. In lakes, productivity per unit area lessens with increases in mean depth, area, slope of shoreline and fluctuations in water level. Thus, enlarging a lake basin by constructing a storage dam will usually increase productive area, but this gain will be offset at least in part by a decline in per unit area productivity. A substantial increase in shore line irregularity or formation of a new shore line with smaller slope may augment productivity. Where the size of a lake basin is small in relation to the volume of inflowing water, an increase in lake volume may temper the deleterious effect of excessive rates of *flushing* (31). In streams, high gross productivity is associated with gentle slope, slow current and stability of flow, all of which provide suitable permanent substrates for the attachment and growth of stream organisms. Productivity is often limited by the lowest seasonal levels of flow (22). Developments which provide stability of flow are thus desirable from the viewpoint of productivity, provided they do not reduce flow below the existing seasonal minimum. Morphometric factors of lakes and streams are commonly the first yardstick by which the effects on fisheries of a development may be appraised (29).

Climatic factors, which are the third determinant of gross productivity, must also be evaluated in anticipating effects of changes to natural water systems, and routine observations usually include temperature, length of growing season, duration and intensity of solar radiation, wind and rainfall. While developments may not directly influence the climate to which a lake is exposed, by changing lake morphometry they greatly modify the interplay of climatic factors and water movements, in this way causing changes in lake structure (1). The prediction of physical conditions that will exist in reservoirs is a relatively new and quite imperfect science that relies heavily on techniques drawn from oceanography. Stream temperatures may also be highly modified by storage developments, with generally a favorable effect on gross productivity if temperature is increased.

The fourth determinant of gross productivity is the group of *biotic factors*, those features of the species and their combinations which determine the degree to which potential productivity is exploited. Because of its geologically recent glaciation, Canada has a deficient complement of fresh-water organisms. In consequence, our freshwaters are highly responsive to introductions (20) of both favorable and unfavorable species. Unfortunately, our present knowledge and experience is inadequate for confident prediction of the effects of many introductions.

To summarize, gross productivity in aquatic environments is influenced by edaphic, morphometric, climatic and biotic factors. The effects of any of man's activities on lake and stream productivity are gauged by their modification of these factors.

Requirements of aquatic organisms

In addition to their effects on the basic factors influencing gross productivity, man's activities may also encroach on certain specific requirements of desirable aquatic plants and animals. Any change in water

quality (temperature, oxygen content, alkalinity etc.,) may be reflected in abundance and production of particular organisms.

Limited temperature tolerances are well known (7). Extremes of temperature can exclude almost all forms, violent fluctuations are tolerated by only a few, and most productive environments have a relatively moderate and stable temperature pattern. Many effects of storage developments on fish populations can be traced to altered water temperatures.

Oxygen requirements of aquatic organisms are typically high. Organic matter and a variety of chemical wastes have a high *oxygen demand* and for this reason are pollutants when added excessively to water (12).

Most organisms also require a medium free of artificial chemical toxins. Heavy metals, cyanides, mercaptins, phenols, chemical insecticides and herbicides, free halogens, oil wastes, detergents and a host of other industrial and domestic by-products (10, 11) are toxins for which complete exclusion is the advisable policy (3).

The consequences of changes in water quality are both quantitative and qualitative. Various species have different preferences and tolerances. Changes to species composition are often the first indicator of effects of man's activities (30). Progressive deterioration is usually associated with elimination of more and more of the original flora and fauna, and may culminate in a barren environment. Greatest concern usually attaches to the effects of changes in water quality on a species of particular interest and use to man.

Requirements of fish populations

In the broadest terms, fish production depends on the excess of growth and reproduction over natural losses and the rate of removal by a fishery. Growth of fish is highly elastic and there are many examples of changes in growth rate in altered environments. In general, an increase in gross productivity is reflected in increased growth rates. Raising of lake levels is often accompanied by an immediate increase in growth rate, but this may often be only a temporary phenomenon and caution in interpreting results is advisable (33, 29). Decreases in growth rate occur both from lowered productivity or from more subtle changes in environment. Fish characteristically feed in stereotyped ways on certain items of food in particular places (16). In a changed environment fish may adapt to new conditions but in some instances may not utilize food resources because of their nature and location.

Adequate reproduction depends on the existence of and access to suitable areas for spawning and rearing. The requirements for a spawning area may be very specific, and adverse effects to fish of many of man's activities can be traced to the impairment of spawning environments. Moreover, the timing of reproduction is usually precise in relation to the natural seasonal chronology. As a result, altering either the physical nature or the seasonal pattern of conditions in areas used for reproduction may have disastrous consequences (1).

Changes to environments may also entail a sharp reduction in fishing. For example, flooding of standing timber in reservoirs restricts the pleasure, convenience, economy and safety of many types of fishing, rendering a lake economically marginal, although it may be potentially productive.

In the whole synthesis of biological factors the combinations of various species in a body of water may be important in the ultimate effect of a change in environment. Altered conditions may shift what had previously been a *balance* in proportions of various species. Many reservoir situations have involved the development of *unbalanced* fish populations in which productivity is high but yield of desired species is low (36). Moreover, the introduction of new forms by removing or by-passing obstructions or by diversion of water from other drainages may have far-reaching consequences. The introduction of lampreys into the upper Great Lakes is a spectacular example. On the constructive side, it is commonly possible to exploit for fisheries purposes the regulation of water level and flow which a reservoir provides. Control of many non-commercial shore spawning species has been attempted by manipulation of reservoir levels and shows some promise (18). The whole field of community structure in fish populations is not well known and perphaps represents one of the most challenging avenues for future research.

Improvement of environment

With the accumulation of research findings and experience with fish populations and their environments, regulations have been devised to insure sustained yield and some notable attempts have been made to improve fish production by altering environment. These improvement projects fall naturally into three categories: manipulation of physical environment, control of undesirable species and culture of fishes.

Manipulation of physical environment

It is a truism that it takes water to grow fish and that the first opportunity for increasing fish production is creation of new bodies of water. Although to date there have been few organized programs for creating lakes and ponds for fish production, there has been a scattering of efforts both individual and governmental which are worth passing mention. In the more heavily developed semi-rural areas substantial numbers of *private ponds* have been created, often at considerable expense to the owner, and sometimes to his disillu-

93452—52½

sionment. Good results have been obtained when design and construction have been based on professional advice. In the prairie provinces, farm dugouts are capable of fish production and perhaps could be developed to the same high degree as is the case in much of the midwestern United States. However, the shorter growing season in Canada militates against either rapid growth or high intensity of harvest.

Akin to creation of new bodies of water for fishing is the raising of water levels to render lakes suitable for desired species. Winter and summer kill of fish can commonly be avoided by the simple expedient of increasing depth and area. Artificial aeration devices have also been developed which achieve essentially the same purpose. Some minor projects of this kind have been mooted, and more will undoubtedly be developed in the future.

A more common form of improvement is the creation of storage for regulation of stream flows, removing the peaks of flood discharge and augmenting flows in drought periods. These techniques have enormous possibilities for increasing production of salmon, but only provided the manipulation of the storage is aimed exclusively at fish production (25). Water storage for power purposes cannot usually be reconciled with stream fish production. Several stream regulation projects designed for fish improvement have been considered on the Pacific coast, and one on the Big Qualicum River (Vancouver Island) is already in early construction stages. Similar developments aimed at production of Atlantic salmon have been suggested.

Anadromous fish production has also been greatly increased by removal of natural obstructions to upstream migration. For many years the federal Department of Fisheries has carried on a systematic program of stream clearance. These local efforts on hundreds of small streams have not been spectacular, but their total contribution to salmon production over the years has probably been substantial. The results certainly have been spectacular in instances of major obstruction, where intensive research studies were made of conditions before and after. The Hell's Gate fishways (which were the solution to a problem of natural obstruction compounded by railway construction), together with other fishways past obstructions in the Fraser River, have probably been the chief factors responsible for the rapid rehabilitation of Fraser stocks to early levels of abundance (32, 37). Similarly, the prompt removal of an obstruction caused by a slide on the Babine River in recent years, probably averted a catastrophic decline (13). Other projects on several minor streams on both coasts have had encouraging results. Present information is sufficient to considerably expand the number of these rewarding projects.

Fertilization of lakes and streams to increase productivity has for many years been a basis for experiment and optimism but to date the results, except in small ponds, have been contradictory and frequently discouraging. Adding nutrients may have favorable effects on aquatic plant production, but the conversion into fish flesh is frequently disappointing. Recent advances in the understanding of water chemistry suggest that considerable fundamental research will be necessary before techniques of water fertilization are achieved which will give the same degree of success as land fertilization (14, 4).

Control of undesirable species

Eradication of undesirable species of animals with the object of decreasing predation or competition on desirable species of fish has been a tool of fisheries science for several decades. Most early efforts in this direction were frustrated by the inadequacy of the eradication. It is now realized that anything short of virtual decimation of predators and competitors is likely to have little effect, or at least only short term effect.

Within the last decade most programs of control have been based on wholesale removal of all species of fish and subsequent restocking with desirable species. While the lake may be removed from production temporarily, the ultimate result is gratifying and in most cases permanent. Small ponds can be drained completely to remove undesirable species and when artificial ponds are constructed the design should allow for draining. Moderate-sized lakes must be treated chemically to eradicate fish stocks. Until very recently this was expensive. The traditional fish-toxicant rotenone, which has not been chemically synthesized, was obtained from tropical America and cost upwards of one dollar per acre-foot for complete kill of all species. Treatment of a lake of 500 acres averaging 30 feet deep would thus cost $15 thousand. Recently, however, many new insecticides have been developed which will kill fish at low concentrations. Toxaphene has been used with success at concentrations below one part per billion at a cost of less than one cent per acre-foot (34, 35). Other insecticides have similar possibilities. Unfortunately, some of these eradicants have several undesirable features. At high concentrations they may have harmful effects on warm blooded animals. It has been speculated that they may become concentrated in the body fats of some organisms exposed to sublethal doses. Toxaphene is relatively stable and disperses in lake water very slowly. Moreover the dose needed to kill fish varies with features of the water chemistry. In consequence, the biologist is caught between two evils, using too little, thus failing to achieve complete kill, and using too much, thus prolonging the period of toxicity. In the largest bodies of water, wholesale treatment with chemical poisons is im-

practical because of the complexity of the drainage systems and the difficulty of achieving complete simultaneous coverage. However, even with these limitations, chemical eradication of fish is now an accepted technique of fish culture and its future refinement will undoubtedly make it even more valuable than at present. To date, perhaps about 200 Canadian lakes have been chemically treated.

The possibility of using chemical toxins which kill only certain species of fish has been encouraged by the development of a compound which at critical doses, kills lampreys but not other species of "fish". As in the case of toxaphene, differences in water chemistry may influence the critical dosage from stream to stream. This compound is receiving its major trial in the Great Lakes, in which the physical size and complexity of the drainage combine with the mechanical and chemical problems of application to pose a formidable obstacle to success. Nevertheless, the program underway represents a major attempt at rehabilitation that would have been beyond the techniques of the previous decade.

The Great Lakes program has also involved the extensive development of electrical methods of eradicating lampreys. In their spawning migrations fish of many species may be vulnerable to electrical diversion or electrocution and a variety of applications of electricity have been developed which exploit these opportunities. Unfortunately, these devices are prone to mechanical and electrical stoppages, in consequence of which they may prove inadequate. However, in special local situations they may be a useful supplemental tool in a broad program of eradication.

Artificial propagation of desirable species

Of all man's attempts to improve fish production, none has been the object of so much attention and optimism as the fish hatchery program. Rooted in European traditions, and predicated on the assumption that natural reproduction was inefficient, fish hatcheries developed into one of the first major fisheries activities of Canadian governmental and private interests. The great and geometric expectations have never been realized, for although it is ridiculously easy to artificially culture the young of some species of fish, for instance salmon, the complexity of the biological world into which the young are planted confounds enthusiastic arithmetic. The bottleneck in natural production may come at some age after planting. Hatchery rearing may have deleterious effects which ill-suit young fish for natural conditions. Techniques of transport and release may result in death after planting. These and other factors have combined to sharply restrict the number of situations in which hatcheries have made a significant contribution. As staging depots for introduction of exotic species or for rehabilitation of exterminated stocks, hatchery facilities are invaluable. They may also be useful in development of stocks of hybrid species such as splake (speckled trout X lake trout). In British Columbia, hatcheries are extensively used for annual stocking of lakes that have no natural spawning facilities, and for production of legal-sized fish for *put and take* recreational angling. In most areas it is recognized that where natural spawning and rearing sites are adequate, hatchery culture is a dubious investment and is never a satisfactory substitute for natural reproduction (8). Some recent experimental ventures in *eyeing* stations and artificial spawning grounds for pink salmon are worthy of mention. Extensive researches have established that pink salmon populations are particularly vulnerable to vicissitudes in stream conditions (39). Freshet conditions, aggravated by removal of plant cover, cause scouring and silting of stream gravels with consequent loss of eggs and fry. In these circumstances, artificial culture may be a cheaper and more practical procedure than storage-regulated flow. Extension of these techniques on a large scale is envisaged as a major fish-cultural activity on the Pacific coast. It would be unfortunate if these developments gave rise to a rebirth of misguided enthusiasm for hatcheries. They represent the culmination of two decades of research and are a specific application of the hatchery technique to a situation in which prior research had proven their applicability. They offer no blanket assurance that hatcheries are the answer to all fisheries problems, for all species of fish, everywhere and always.

Effects of other resource uses

Aquatic environments are susceptible to both direct and indirect effects from the development of resources other than fisheries. Most obvious are the direct effects associated with the use of the water resource for power and irrigation or as a disposal system for wastes. Equally important, but less conspicuous in origin, are indirect effects associated with land-use and watershed control. No attempt is made here to catalogue the diversity of local situations voluminously documented in governmental files. Rather, some major problems and the approaches taken to them are outlined, and some observations are made about likely developments in the future.

Pollution

Except for some of the more urban or industrial areas, there have been relatively few serious cases of pollution of streams in Canada to date. Several instances of sewage or organic wastes causing local oxygen depletion have been recorded. Mining mill pollution has occurred locally in many areas. Industrial pollu-

tion is a growing problem. Nuclear pollution is a possible future problem for which, fortunately, there promises to be abundant technical information. There have been many pollutions of lakes and some notable local marine or estuarine pollutions, and some of these problems have recently assumed substantial proportions (for example, Lake Erie (15), and possibly the North Arm of the Fraser River under certain circumstances). The encroachment on major river systems has not reached the serious levels witnessed in many parts of Europe and the industrial United States. Nevertheless, fisheries agencies in the past decade have been forced to pay increasing attention to pollution problems, implementing the provisions of the Fisheries Act and anticipating the future problem by ensuring consideration of fisheries in the gradual development of the multiple resource potential of river basins. There has also come a realization that the path for the future will be beset with difficulties peculiar to the pollution problem.

In the first place it is difficult to prove that a pollution occurs or is deleterious. Fish may quickly leave a polluted area, or they may remain in the vicinity of the pollutant, their growth or vitality impaired. The stress imposed on aquatic organisms may be of an indiscriminate kind – not noxious in itself but predisposing the fish to mortality from natural factors with which they would otherwise be able to cope (6). Even with dead fish in hand and evidence of pollution, the case may remain circumstantial because of inadequacy of techniques of fish pathology. In many instances fish can withstand limited pollution, but with the addition of a new pollutant the total load becomes intolerable. The question then arises, which is to blame?

A second problem is posed by the complexities of modern industrial technology. The effects of many of these compounds on fish and aquatic organisms have not been assessed. It is suspected that many synergistic and antagonistic effects occur, in which a compound is only harmful in the presence or absence of another. To give a simple example, heavy metals are most harmful in water deficient in calcium. The possibilities for complex interaction in organic compounds are manifold.

Finally, as an administrative complexity, there are a large number of agencies which for one reason or another have an interest in pollution. Public health may be at stake, industrial uses may be limited, recreational values may be impaired, and in each case the criterion of acceptability may be at variance with the fisheries requirement.

In all these circumstances it would seem that the approach of fisheries agencies should be unilateral, demanding, persistent, and without any guarantee that future requirements may not be more stringent. Almost without exception, the approach to a new industrial water user should be that all pollution is to be avoided. However, in many instances, a new industry may represent an economic asset to the community which apparently overrides the fisheries loss. Moreover, enforcing a harsh policy on water licensees who have been polluting water without interference for decades, may involve considerable expense. Many treatment facilities are expensive even when incorporated in initial construction; when they must be added as an afterthought , they may become prohibitive.

In consequence of the biological, administrative and economic complexities, the approach to pollution problems in Canada as a whole has been many-sided – in some areas vigorous, in others lax, in some expedient. Collectively, the situation is ambiguous, arbitrary and confusing to the industrial water user.

Similar problems were experienced in the United States several decades ago, and out of the confusion there solidified many *pollution control boards* which would work in conjunction with *river basin development commissions*. Charged with the responsibility of collating the various criteria of tolerance and subsequently *planning* when and where and what degree of pollution would be permitted, these agencies have achieved various degrees of success. On occasion they may provide only an additional bureaucratic brake on action as well as an expensive rationalization of everything that would have happened without them. But where they have come closer to realizing their idealistic objective they have done great service both in protecting fisheries where justified and in preserving the public interest as a whole. At present there are several relatively newly-organized planning groups of this kind in Canada and their growth will be a matter of great interest. A national conference on the problem of pollution as a whole in Canada would probably be very useful.

Fish and Dams.

On both coasts of Canada where important stocks of anadromous fish provide for both commercial and sports fisheries, the problem of fish and dams has assumed importance in recent years. Each dam poses some local or peculiar features, so that highly technical investigation and individual design are required for adequate protection (17). The literature is voluminous and involves many aspects of biology and engineering.

The general features of the problem and the current knowledge of solutions have been fully outlined in several recent publications. Most notable are an extensive review of Fraser River fish-power problems by Andrew and Geen (1) and a forthcoming book by Clay (9).

Briefly stated, the questions are – how to transport adult fish safely up over dams and young fish safely down, and how to provide adequate spawning and rearing facilities when either is eliminated or reduced.

For small dams on small rivers the techniques of constructing fishways for adults and diverting young fish into safe bypasses have been developed to the point that a satisfactory arrangement can usually be achieved, provided there is sufficient and early technical liaison. In some instances, the cost of protective facilities appears excessive to the dam-builder, but continued negotiation, improvements in economy of design and increasing understanding seem to be gradually shaping the solutions of most controversies.

The same cannot be said for problems posed by major dams on large rivers with big runs of anadromous fish. Using the known techniques it has been estimated that the cost of fish protection facilities for an integrated power development on the Fraser River would be over $300 million (2). (This estimate was derived for a development plan which involves diversion of the Columbia River near Revelstoke. While a diversion of the Columbia is no longer a consideration, the estimate remains as a useful example.) And there is no assurance that these facilities would work. The alternatives are, therefore, fish or power. The run has an annual value approximating $25 million with the prospect of a greater potential. At this time the power is not sufficiently valuable to warrant the sacrifice of such a substantial economic and social asset. This situation does not reflect inadequacy of investment in research that would lead to solutions. In the past decade the expenditure on fish-dam research in the Pacific northwest has been in excess of $2 million a year. In Scandinavia, the United Kingdom, continental Europe and eastern North America sizeable investments have also been made in research and experimental facilities. Similar problems are being studied in India, the U.S.S.R., Eire, Australia and New Zealand. The problem is large and the solution will require a substantial accumulation of knowledge and experience.

Land Use

The quantity and quality of water in lakes and streams are closely related to the prevailing practices of land husbandry. In natural undisturbed situations, the plant cover is a substantial modifier in the hydrologic cycle, in two ways. First, plants absorb large quantities of precipitation and return it by transpiration to the atmosphere, in effect removing it from the lake and stream cycle. Secondly, they provide a large surface area which not only acts as a sponge-like reservoir, but affords opportunity for evaporation. When plant cover is stripped, as in clear-cut logging, peaks in stream discharge are sharply exaggerated, and seasonal low flows are much more severe. Soils become more compacted and permeability may be decreased. A greater fraction of the precipitation runs off the soil surface. Subsequently, soil erosion may increase turbidity in streams. The absence of shade may cause higher stream temperatures. Increased peak flows may cause the scouring of new stream channels, which aggravate low flow situations by distributing the available water over wide expanses of exposed porous gravel. Most of these effects can be avoided by sustained yield forestry with patch or selective logging (27).

Logging may also have other direct effects on fisheries. Slash and debris commonly cause minor obstructions in streams. Logging roads when carelessly constructed may cause silting and erosion. Log driving in streams is usually harmful because of gouging of bars, channel erosion and obstruction. Sawdust disposal in lakes and streams smothers bottom organisms. All of these effects can be avoided by good logging practices, and there is a growing tendency to require protection of fisheries as part of government agreements to logging rights.

A recent conflict of interest between forestry and fisheries has occurred with large-scale spraying for forest insect pests. Aerial spraying with insecticides usually involves contamination of streams unless great care is exercised in the application. On both east and west coasts studies have demonstrated the losses of fish caused by aerial spraying, and as yet no completely satisfactory solution to the problem has been developed. A bacteriocidal spray, lethal only to some species of insects, has been devised and may prove to be the answer.

The effects of agriculture on fisheries in large part follow a similar pattern to those outlined for forestry. Poor agricultural techniques which contribute to soil erosion have repercussions in streams. Lavish applications of herbicides and insecticides may cause losses of young fish in streams. Diversion of water is a substantial feature of the effects of agriculture on fisheries. Many irrigation developments, like domestic or industrial diversions, can create extremely low flows in the dry seasons. In addition, of course, they may funnel fish which are going downstream into particularly unsuitable dead ends. The usual fisheries requirements are for maintenance of a minimum low flow and screening of diversions to prevent loss of fish. Both of these requirements are hard to achieve in long established agricultural areas, where the stream flow has long since been overlicensed and the farmers or other water users are reluctant to undertake either the initial cost or maintenance of screening devices. However, some progress is being made on these inheritances, and in many parts of

Canada new water licences are carefully checked so that the appropriate provisions for fish protection can be made.

Finally, it should be underlined that good agricultural practices may augment fisheries production. Fertilization of soil is not without benefits to aquatic production. The addition of organic matter to the soil has stabilizing effects on stream flows. Provided with suitable screens and *return plumbing*, irrigation diversions can be exploited as fish producers. Storage reservoirs for irrigation may create new fishing waters. Storage dams on lakes may prevent excessive drops in lake levels in the early summer months. In short, there are many opportunities for agriculture and fisheries to work to mutual advantage.

The Marine Environment

By contrast with freshwater, in which the emphasis is on environmental manipulation, there are rather few instances in which man can influence the marine environment, either unwillingly or by design. Nevertheless, in some local near-shore situations marine pollutions have threatened or occurred, and in one notable project on the Atlantic coast there may be possibilities for obstruction and changes in productivity.

Pollution of the sea usually occurs in areas of restricted circulation in which noxious substances cannot be dissipated rapidly. Oysters and other sessile, near-shore forms may be harmed by smothering with pulp mill effluent, or excessive quantities of silt. Local oxygen depletion in inlets can threaten marine fishes. Oil is a common harbor pollutant. In these instances requirements for treatment of effluent may be as rigid as for freshwater situations. Tidal conditions and mixing of fresh and salt water in estuaries and inlets complicate the physical analysis of marine pollution, making the need for research and the opportunities for argument even greater than in fresh water. However, some notable studies have been made in Canada, and the problem is under continuing surveillance (38).

Until recently, disposal of nuclear waste in the sea had been endorsed as a solution to a new and unique problem. This optimism has proved short lived with the observation that even in the deepest trenches of the sea there is sufficient water movement to spread any waste material into general circulation.

The Passamaquoddy project on the Atlantic coast and similar projects mooted for some Pacific coast inlets have raised the possibility that the harnessing of tidal power with low head turbines may have some unique problems and perhaps benefits for fisheries. With so little precedent for this kind of development, research needs have been large and have been met by a major investigation. It must suffice to say that the problems are complex but apparently not irreconcilable to fisheries (5,19,23,40).

For all these problems involving the circulation of sea water, it is apparent that there is a great need for further oceanographic investigation and research.

The Resolution of Resource Conflicts Involving Fisheries

In the broad view there have been few permanent, broad and damaging effects on Canadian fisheries to date. Intensive resource development has been confined to a relatively recent period. Moreover, from the outset, fisheries were a sufficiently valuable resource to have representation by a federal minister. In consequence, fish protection has received substantial emphasis despite the fact that resource development has been in its early stages. The degree of recognition of problems encourages optimism for the future.

In one respect, however, the present organization of fisheries protection seems outmoded and inadequate. The British North America Act places responsibility for fisheries with the federal government, although varying degrees of responsibility have been delegated to the different provinces (26, 24). As a result a strong interest in fisheries has not been developed in those provinces where the federal responsibility is still quite comprehensive. On both coasts (with the exception of Quebec) the provincial governments have little machinery for consideration of the problems of one of their biggest resources.

The lack of strong provincial fisheries agencies in the coastal areas is particularly apparent when problems of resource use conflict, such as pollution or fish-power, arise. Opinions have been expressed that the B.N.A. Act is contradictory, for while the provinces control their resources, for example water, their recommendations regarding water use may be contradicted by the Federal Fisheries Act. Regardless of the legality of the matter, it is certainly apparent that a fisheries awareness at the provincial level would save many potentially embarrassing and difficult problems. Until the present, co-operation at the technical level between federal and provincial agencies has been a model of practicality and there have been few occasions on which the theoretical jurisdictional problem has been raised. But it would be optimistic to believe that such a pleasant liaison will persist in the planning-conscious future. Provinces will plan their resource development, and it will be for the better if they do it with an awareness of their obligation to fisheries. The coastal provinces should have legislation duplicating provisions of the Fisheries Act, and should have departments which are responsible for their enforcement, even though

they may rely heavily on the federal department for technical assistance. The important thing is that the provincial legislation and administrative framework should be in existence to clarify the legal position and to ensure awareness of fisheries problems in resource development.

The federal Fisheries Act is in many respects most appropriate for the job of fish protection. Many of its clauses are all-encompassing; it is unlawful to put anything in the water that may harm fish; the Minister of Fisheries can require what he feels is necessary for fish protection at dams. This kind of power must of course be used with appropriate discretion. In general, the federal Department negotiates rather than dictates; educates rather than convicts, reserving the power of the Fisheries Act for situations where its intent is clearly being flagrantly abused. This approach has had rewarding consequences, with the department leading a general public acceptance.

The services of professional personnel have been a large factor in the success with which fisheries conservation has proceeded in Canada. The Fisheries Research Board of Canada and some of the provincial agencies have provided a substantial background of research, both applied and fundamental. The Fish Culture and Development Branch of the federal Department of Fisheries and some similar provincial departments have greatly expanded the application of these findings, and most importantly have been able to provide detailed investigation of local projects. It cannot be too strongly emphasized that the success of fish conservation has proceeded almost in direct proportion to the availability of professional staff for intensive studies.

A concluding comment is that to date Canada has successfully handled the problems for fisheries involved in development of natural resources. Moreover, the strong federal emphasis on fisheries, particularly through the Fisheries Research Board, has laid a good groundwork for future improvement of fisheries by both federal and provincial agencies. Undoubtedly, the developments in the next few decades will be decisive in determining whether this favorable trend will continue into the indefinite future.

References

[1] Andrew, F. J. and G. H. Geen. *Sockeye and pink salmon production in relation to proposed dams in the Fraser River system.* International Pacific Salmon Fisheries Commission. Bulletin XI. 1960. p. 259.

[2] Anonymous. *A report on the fish facilities and fisheries problems related to the Fraser and Thompson river dam site investigations.* Report by Department of Fisheries of Canada, International Pacific Salmon Fisheries Commission in collaboration with B. C. Fisheries Department and B. C. Game Commission. 1955.

[3] Anonymous. *Toxic effects of organic and inorganic pollutants on young salmon and trout.* State of Washington, Department of Fisheries, Research Bulletin 5. 1960. p. 264.

[4] Ball, R. C. 1950. *Fertilization of natural lakes in Michigan.* Transactions of American Fish Society 78 (1948): pp. 145-155.

[5] Bell, M. C., and C. H. Clay "*Facilities for anadromous fish passage. Passamaquoddy project*", *J. Fish. Res. Bd. Canada,* 17(4): 1960. 507-516.

[6] Brett, J. R. *Implications and assessments of environmental stress.* University of British Columbia, H. R. MacMillan Lectures in Fisheries. 1958. pp. 69-83.

[7] Brett, J. R. *Thermal requirements of fish — three decades of study, 1940-1970.* Trans. 2nd Seminar on Biol. Probs. in Water Pollution. U. S. Public Health Service. Cincinnati, Ohio. 1959. p. 8.

[8] Clay, C. H. and P. A. Larkin. *Artificial propagation is not the answer.* B. C. Prof. Engineer. March 1959.

[9] Clay, C. H. (in press). *Design of fishways and other fish facilities.* Publ'n. Dept. of Fisheries Canada.

[10] Doudoroff, P. and M. Katz. "Critical review of literature on the toxicity of industrial wastes and their components to fish. I. Alkalies, acids, and inorganic acids", *Sewage and Industrial Wastes 22 (11) 1950.* pp. 1432-1458.

[11] "Critical review of literature on the toxicity of industrial wastes and their components to fish. *II.* The metals, as salts" in *Sewage and Industrial Wastes 25 (7). 1953.* pp. 802-839.

[12] Doudoroff, P. *Biological observations and toxicity bioassays in the control of industrial waste disposal.* Proc. 6th Indus. Waste Conf. Purdue Engin. Extens. Bull. 76, Vol. 35 (6). 1951. pp. 88-104.

[13] Godfrey, H., W. R. Hourston, J. W. Stokes and F. C. Withler. "Effects of a rock slide on Babine river salmon," in *Bull. Fish. Res. Bd. Canada,* 101. 1954. pp. 100.

[14] Hayes, F. R. 1951. "On the theory of adding nutrients to lakes with the object of increasing trout production", in *Canadian Fish Culturist, 10.* 1951. pp. 32-37.

[15] Hile, R. *Changing concepts in fishery research on the Great Lakes,* Proc. Gulf and Caribbean Fish. Inst. 6: 64-70. 1953.

[16] Hoar, W. S. "The analysis of behavior of fish." University of British Columbia, *H. R. MacMillan Lectures in Fisheries.* 1958. pp. 99-111.

[17] Hourston, W. R., C. H. Clay, L. Edgeworth, P. A. Larkin, E. H. Vernon and R. G. McMynn. *Planning anadromous fish protection for proposed dams.* Trans. 20th North American Wildlife Conf. 1955. pp. 440-454.

[18] Jeppson, P. *The control of squawfish by use of dynamite, spot treatment, and reduction of lake levels.* Prog. Fish-Cult., 19 (4) 1957. pp. 168-171.

[19] Kerswill, C. J. "Effects of proposed Passamaquoddy power project on anadromous fishes in Canadian waters", in *J. Fish. Res. Bd. Canada,* 17(5) 1960. pp. 713-720.

[20] Larkin, P. A. "Introductions of the Kamloops trout in British Columbia Lakes," *Canadian Fish Culturist,* (16). 1954. pp. 1-10.

[21] Larkin, P. A. *The effect of various conservational measures or works on the aquatic environment and on the stocks of that environment.* Proc. Intl. Union for Conser. Nature and Natural Res. VII Technical Meeting. 1959.

[22] Maher, F. P. and P. A. Larkin. *Life history of the steelhead trout of the Chilliwack river, British Columbia.* Trans. Amer. Fish Soc., (1954) 84. 1955. pp. 27-38.

[23] Martin, W. R. "Predicted effects of proposed tidal power structures on groundfish catches in Charlotte County, N. B.," in *J. Fish. Res. Bd. Canada,* 17(2) 1960. pp. 169-173.

[24] Munro, D. A. *Legislative and Administrative Limitations on Wildlife Management.* Resources for Tomorrow Conference, 1961.

[25] Neave, Ferris. "Stream ecology and production of anadromous fish". University of British Columbia, *H. R. MacMillan Lectures in Fisheries.* 1958. pp. 43-48.

[26] Ozere, S. V. *Survey of Legislation and Regulations Affecting Fisheries.* Resources for Tomorrow Conference, 1961.

[27] Pennell, J. T. "Effects on fresh water fisheries of forestry practices". In "The Effects on Freshwater Fisheries of Man Made Activities in British Columbia" by P. A. Larkin and graduate students. in *Canadian Fish Culturist 25.* 1959. pp. 1-33.

[28] Rawson, D. S. "Some physical and chemical factors in the metabolism

of lakes", in *Problems of Lake Biology*. Publ. AAAS. No. 10. 1939. pp. 9-26.

[29] Rawson, D. S. "Indices to lake productivity and their significance in predicting conditions in reservoirs and lakes with disturbed water levels." University of British Columbia, *H. R. MacMillan Lectures in Fisheries*. 1958. pp. 27-42.

[30] Richardson, R. E. *The bottom fauna of the Middle Illinois River, 1913-1925. Its distribution, abundance, valuation, and index value in the study of stream pollution*. State of Ill. Div. National Hist. Surv., 17. 1928. pp. 387-495.

[31] Robertson, G. J. G. "The trophic status of Port John lake, British Columbia," *J. Fish Res. Bd. Canada*, 11(5). 1954. pp. 624-651.

[32] Royal, Loyd A. "The effects of regulatory selectivity on the productivity of Fraser River sockeye," *Canadian Fish Culturist* 14. 1953. pp. 1-12.

[33] Runnstorm, S. Changes in fish production in impounded lakes. *Proc. Intern. Assoc. Theor. and Appl. Limn.* 1955 pp. 176-182

[34] Stringer, G. E. and R. G. McMynn. "Experiments with toxaphene as a fish poison," *Canadian Fish Culturist, 23*. 1958. pp. 39-47.

[35] Stringer, G. E. and R. G. McMynn. "Three years' use of toxaphene as a fish toxicant in British Columbia", *Canadian Fish Culturist*, 28. 1960. pp. 37-44.

[36] Swingle, H. *Relationships and dynamics of balanced and unbalanced fish populations*. Bull. 274, Agric. Exptl. Stn. Alabama Polytechnic Institute. 1950. p. 73.

[37] Talbot, G. B. 1950. A *biological study of the effectiveness of the Hell's Gate fishways*. Int. Pac. Salmon Fisheries Comm., Bull. 2. 1950. pp. 7-80.

[38] Tully, J. T. "Oceanography and prediction of pulp mill pollution in Alberni inlet", *Bull. Fish. Res. Bd. Canada 83*. 1949. p. 169.

[39] Wickett, W. P. "Review of certain environmental factors affecting the production of pink and chum salmon," *J. Fish Res. Bd. Canada*, 15(5). 1958. pp. 1103-1126.

[40] Wilder, D. G. "Possible effects of Passamaquoddy tidal power structures on the Canadian lobster industry", *J. Fish. Res. Bd. Canada*, 17(4). 1960. pp. 553-563.

Survey of Legislation and Treaties Affecting Fisheries

S.V. Ozere,
Assistant Deputy Minister,
Canada, Department of Fisheries,
Ottawa

The main objective in fisheries management is to maintain and, if possible, increase the sustainable yield. Many types of measures are used for that purpose, based on results of scientific investigations.

From the viewpoint of national jurisdiction, fisheries in Canada are constitutionally a subject of legislation for the Parliament of Canada, although in non-tidal waters the provinces have property rights in fisheries and may therefore legislate as to their disposal, subject to federal legislation imposing any restrictions on fishing. In some respects federal and provincial legislative jurisdiction may overlap, in which case co-operative arrangements are made to bring about the necessary co-ordination. Some provinces administer their own fisheries and by arrangement with the Federal Government enforce the federal fishery regulations.

In the management of sea fisheries and anadromous fisheries, it is necessary to make treaties with other countries interested in any fisheries which are also of interest to Canada. For this purpose, a number of bilateral and multilateral conventions have been made and international commissions established to recommend to the governments of the participating countries, on the basis of scientific investigations, any necessary conservation measures. Some progress has also been made in the development of international rules of general acceptance under the sponsorship of the United Nations Organization.

Meaning of Fisheries and Conservation

Legal problems of a jurisdictional nature encountered in the conservation of fisheries in Canada are mainly of two kinds: the problems arising out of the division of legislative powers between the Parliament of Canada and the legislatures of the provinces, and those having their origin in international law and practice. This paper contains a brief survey of these problems and reviews the legal expedients adopted to make possible the conservation of the fisheries resources.

For the purposes of this paper, it will be necessary to deal with fisheries from the viewpoint of area and of the particular resources involved. In relation to area, two broad divisions will be considered, namely the inland or non-tidal fisheries, and the marine or tidal fisheries. In relation to the particular resources involved, it should be understood that the term *fisheries* includes not only fish in its ordinary sense, but also sea mammals, such as whales and seals; crustaceans, such as lobster and crabs; mollusks, such as oysters, scallops, clams, etc., and other living aquatic resources.

Conservation may mean many things to many people, but its meaning in this paper is limited to the aggregate of measures required for the maintenance or, if possible, the increase in the sustainable yield of the resource to which the measures are applied.

Types of Conservation Measures

Depending on the nature of the resource and the way in which it is harvested, the following are some of the general types of measures used in a conservation program:

(i) regulation of the amount of fishing: by limiting the total catch by means of an over-all quota, or by close seasons, closed areas, or by limitation of the fishing gear;

(ii) regulating the sizes of fish taken by regulating the fishing gear to achieve differential catching of specified sizes, as well as prohibiting the landing of fish below a specified size, also by prohibition of fishing in areas where or seasons when small fish predominate:

(iii) regulations designed to assure adequate recruitment by control of the amount of fishing and differential harvesting of different sizes of fish, by prohibiting fishing in spawning areas or during spawning seasons, by preservation and improvement of spawning grounds and by differential harvesting of sexes to achieve a desirable sex ratio in the population, as in the case of some sea mammals.

In addition, environmental improvement projects designed to improve the habitat of the fish are applied mainly to freshwater and anadromous fisheries. These include stream bank and stream bed erosion control, preservation of consistent adequate water flow, removal of natural obstructions and the building of fishways, construction of artifical spawning area and control of predators, pollution and temperature. Artificial propagation is also of value in maintaining certain fisheries.

The determination of which of these measures should be applied in a particular conservation program depends on knowledge of the life history, population dynamics and behavior of the species constituting the resource and on the technical nature of the fishing. Thus recommendations for regulations must generally be made on the basis of prior scientific investigations.

Legislative Jurisdiction in Canada Respecting Fisheries

Unlike the situation in the United States, where fisheries are a legislative subject for each state of the Union, in Canada legislative jurisdiction over fisheries was vested in the federal Parliament. This was done mainly to prevent conflict which could otherwise have been engendered in areas where certain bodies of water border on more than one province; we have, for example, five provinces bordering on the gulf of St. Lawrence. Regulation of fisheries would be very difficult in such case unless there was complete agreement and co-ordination between the provinces concerned as to the necessity or the kind of measures required for the management of the fisheries involved.

In recent times a number of international conventions for the conservation and protection of sea fisheries have been made, to which Canada is a party. Here again, unifield jurisdiction over fisheries facilitates negotiation of the treaties as well as implementation of the obligations assumed thereunder.

(By head 12 of section 91 of the British North America Act, 1867, the Parliament of Canada is given exclusive legislative authority over "Seacoast and Inland Fisheries".)

Immediately following Confederation, the Government of Canada assumed complete control over the fisheries of Canada. It was not long, however, before disputes arose as to proprietary rights in certain fisheries. Some of the provinces claimed these in virtue of section 92, head 13, of the British North America Act, which gives the legislatures of the provinces authority to make laws in relation to *property and civil rights*. These disputes culminated in a reference to the Judicial Committee of the privy Council in London in 1898.

The Privy Council decided that the grant to the federal Parliament of legislative powers in relation to fisheries did not also transfer proprietary rights, which remained with the provinces unless expressly transferred to Canada, and that therefore the provinces may legislate as to fisheries from the point of view of property and civil rights, for instance, prescribing the mode in which a private fishery is to be conveyed or leased, or the rights of succession in respect of it; the terms and conditions on which any fisheries owned by the provinces may be leased, etc. Apart from this, the Privy Council held that the enactment of fishery regulations is within the exclusive competence of the federal Parliament and is not within the legislative powers of the provincial legislatures. It further decided that in legislating in relation to fisheries, the federal Parliament is empowered to affect proprietary rights in the province in so far as it may be necessary for the regulation of fisheries. The same case laid down that both the central and local governments have power to impose licence duties on fishing for purposes of taxation.

Following this decision of the Privy Council, conferences were held for the purpose of reaching some means of administering the different functions devolving on federal and provincial governments. Proprietary interests in the fisheries were handed over to those provinces which claimed them, and in those provinces the federal staff of fishery officers was withdrawn and replaced by a staff of provincial officers.

Some of the sea-washed provinces further claimed proprietary rights, not only in inland or non-tidal waters, but also in tidal waters. This question was settled in two further references to the Imperial Privy Council in 1913 and 1920, the first involving British Columbia, and the second, Quebec.

The Privy Council held that it is only in non-tidal fisheries that proprietary rights exist, and that fisheries in tidal waters (in Quebec the navigable tidal waters) are public fisheries. The management and protection of these public rights of fishing, having been placed by the British North America Act within the exclusive legislative jurisdiction of the Parliament of

Canada, there was nothing left within the domain of the provincial legislatures in these waters and therefore no right of property or control in them.

Although the power to make laws for the regulation of fisheries as such is exercised by the federal Parliament, enforcement of these laws has been in some instances undertaken by the provincial authorities, especially in the case of inland waters, where sport fishing is chiefly involved and where enforcement of fisheries laws can conveniently be combined with enforcement of provincial game laws. In such instances, the federal Government enacts the required regulations on recommendation of the provincial authorities concerned.

Laws in relation to fisheries, enacted by the federal Parliament, sometimes cut across provincial legislation relating to property and civil rights as, for example, in the case of provincial laws regulating the use of water resources for domestic and industrial purposes. As has already been pointed out, the Privy Council held that in making laws relating to fisheries, the federal Parliament may affect property rights. In discussing the reasons underlying the decision, the Lord Chancellor of the Judicial Committee, referring to the 1898 Fisheries Reference Case, states, "Even in the case where proprietary rights remain with the province, the subject matter may be of such a character that the exclusive power of the Dominion to legislate in regard to fisheries may restrict the free exercise of provincial rights."

The fisheries laws which require other water users to provide for the protection of fish life are an example in point. Under provincial legislation respecting the use of water resources, a licence may be required for the use of water for power, irrigation, or other purposes. But, having obtained a licence from the provincial authority, the licensee must also comply with federal fisheries laws for the protection of fish life.

In those provinces where fisheries and water power are each an important resource, means must be found to co-ordinate the administration of the federal fisheries laws with the provincial laws regulating the use of water. This is only one of the more important examples where federal and provincial laws cut across each other's jurisdictions. In all such cases, co-ordination must be established between the federal and provincial authorities to achieve the harmonious blending of the constitutional processes.

Fishery Regulations

In the exercise of its constitutional powers, the Parliament of Canada has passed a number of statutes relating to fisheries. The basic statute with respect to the conservation of fisheries is the Fisheries Act, R.S.C., Chapter 119. The Act applies to fish, shellfish, crustaceans and marine animals. It is from this statute that the Government of Canada derives its power to make regulations for the proper management and regulation of the seacoast and inland fisheries.

Regulations, including the type of measures mentioned in the introductory part of this paper, have been enacted separately for each province as well as for Yukon and the Northwest territories, or generally, for a particular resource (see Appendix "A").

The regulations so enacted are applicable to Canadian waters and to persons subject to Canadian Jurisdiction. In the inland provinces of Canada and in Quebec, and with respect to non-anadromous species of fish in the non-tidal waters of British Columbia, these regulations are recommended and enforced by the provincial governments concerned. In New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland, the Yukon, the Northwest Territories, and the tidal waters of British Columbia, as well as in non-tidal waters in respect of the anadromous of fish, the federal government enforces the fishery regulations passed by the Governor General in Council on the recommendation of the Minister of Fisheries after the necessity for such regulations has been established by research carried out by federal officers.

Legislation and Treaties Respecting International Fisheries

The principal commercial fisheries in Canada are found along the seacoasts. As long as the resources of the sea fisheries are harvested exclusively by Canadian fishermen or in Canadian territorial waters, regulation thereof for conservation purposes can be achieved within the framework of the legislation above mentioned. For example, for such resources as the lobster and the oyster, which are localized mostly in Canadian territorial waters, conservation measures are adequate if applied only to Canadian fishermen. In many instances, however, resources harvested by Canadian fishermen in or out of Canadian territorial waters are also exploited by fishermen of other countries in the high seas adjacent to Canadian territorial waters. In such instances, regulation for conservation purposes would be difficult to undertake without the agreement and cooperation of the countries to which the fishermen belong. Thus the principal species of groundfish on which the commercial fishery of the Atlantic Coast is based roam over wide areas of the Atlantic Ocean in the territorial waters of Canada as well as hundreds of miles out to the edge of the Continental Shelf. For se-

veral centuries these fish have been exploited by the fishermen of Europe as well as those of North America. Similarly, on the Pacific Coast of Canada, the fishery resources on which the Canadian fishing industry depends are accessible to foreign fishermen beyond Canadian territorial waters.

The same problem exists in the inland boundary waters between Canada and the United States, for instance, in the Great Lakes region, where the same populations of fish are exploited on both the Canadian and the United States sides of the boundary.

To meet the problems of conservation in these fisheries, a number of treaties have been negotiated with those countries interested in participating in these particular fisheries.

We will now proceed to a brief review of these treaties, the reasons for their negotiation, and their objectives.

Convention Between Canada and the United States for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea

This convention was the first treaty to provide for the joint regulation of a specific fishery by an international commission. It also contributed significantly to the progressive development of Canada towards national sovereignty, since it was the first treaty of any kind which Canada signed in her own right.

The halibut fishery in the North Pacific Ocean has been participated in by fishermen of Canada and the United States since the end of the 19th Century. The unregulated fishery flourished until 1915 when the annual catch began a steady decline in spite of an increased fishing effort.

As a great part of the catch came from beyond the territorial waters of Canada and the United States, effective conservation measures could only be applied by common agreement between the two countries.

The existing convention, which has been revised three times since it was signed in 1923, provides for the appointment of a six-man commission – three from each country – with powers to apply a number of specific conservation measures for the purpose of developing the stocks of halibut of the North Pacific Ocean and Bering Sea to levels which will permit the maximum sustained yield from the fishery and of maintaining the stocks at those levels.

Since 1931 the commission has controlled the amount of the catch that can be taken each year. The halibut fishing grounds have been divided into areas and the catch from each area limited, either directly by catch quota, or indirectly, by length of fishing seasons. Regulation restricting the type of gear used and closing nursery areas have also been adopted. The regulations are issued on an annual basis and must be approved by the Governments of Canada and the United States before they come into force. The regulations are enforced by the appropriate government agencies of Canada and the United States. Implementing legislation for this convention is contained in the Northern Pacific Halibut Fishery Convention Act, Statutes of Canada, 1953, Chapter 43.

Convention Between Canada and the United States of America for the Protection, Preservation and Extension of the Sockeye Salmon Fisheries in the Fraser River System, Signed at Washington on the 26th Day of May 1930 and a Protocol Thereto Signed at Ottawa on the 28th Day of December 1956

This bilateral convention between Canada and the United States, although signed in 1930, was only brought into force in 1937, following ratification by the two contracting governments. The original convention covered only the sockeye salmon of the Fraser River system. By a protocol signed in 1956, pink salmon was included. A commission, composed of three representatives from each country, makes regulations which, unless they are of an emergency nature, are subject to approval by the two contracting governments. Enforcement of the regulations is carried out by the appropriate government agencies of the two countries. The commission is charged with responsibility not only of formulating conservation measures, but also of regulating the catch of the fishermen of the two countries in order to provide in so far as possible an equal annual production.

The sockeye and the pink salmon of the Fraser River system are the two most important species from the viewpoint of production. Although bred in the Fraser River watershed, the salmon spend the greater part of their life cycle in the Pacific Ocean and are caught by the fishermen of Canada and the United States on their return journey to spawn in the waters of the Fraser River system. As large numbers of the stock pass through the territorial waters of the United States, where the catch is available only to United States fishermen, effective conservation measures could not be undertaken without the co-operation of the two countries. Hence, the necessity for and the origin of this convention.

The remaining three species of salmon found in the Fraser River system, chum, spring and coho, are not included in the convention, but conservation measures for these species are adopted as required by the go-

vernments of the two countries in respect of their own nationals. Where it is necessary to bring about co-ordination of any conservation measures, arrangements are made for that purpose at informal conferences between the appropriate government agencies of Canada and the United States.

Salmon management requires the application of a great variety of conservation measures, not only regulating fishing activities, but also governing environmental improvement in the inland rivers and lakes; such as maintaining adequate water flow; maintenance of gravel beds for spawning; control of water temperatures; removal of natural obstructions and the building of fishways; pollution control; construction of artificial spawning areas.

The Pacific Salmon Fisheries Convention Act, Statutes of Canada, 1957, Chapter 11, contains the implementing legislation giving the Government of Canada the necessary authority to carry out and give effect to the provisions of the Convention.

International Convention for the High Seas Fisheries of the North Pacific Ocean Between Canada, Japan and The United States, Signed at Tokyo on the 9th Day of May 1952

There are situations where the conservation of certain living resources of the sea would be difficult unless the harvesting of the resources was limited to those nations who have contributed to their development and maintenance. The problem can best be explained by reference to a specific fishery such as the salmon fishery of the Pacific Coast of North America. This species, as has already been indicated, breeds far inland in the rivers and lakes of Canada and the United States, but spends part of its life cycle far out at sea – hundreds, and at times thousands of miles away from the breeding grounds to which it will return to spawn and die. On its return journey to spawn in the inland waters, the run of salmon may be intercepted and caught at sea many hundreds of miles away from the coast.

To preserve this species, Canada alone, or in some instances jointly with the United States, spends millions of dollars in research, in close supervision of the migrating salmon and of the fishing operations; in providing hatcheries and in building expensive fishways; in stream clearance and other measures to improve the freshwater habitat of this species. Other users of the water resource have restrictions placed on their developments in order to maintain the runs of this valuable article of food.

Under these circumstances, it would be difficult to undertake the required conservation measures unless some means were found to reserve the harvesting of this resource to the nations who have developed and are maintaining the resource at considerable national cost.

To meet this problem, Canada, Japan and the United States, being the three principal countries then interested in the fisheries of the North Pacific Ocean, signed a Convention in Tokyo in 1952, which embodies a formula to meet the situation. The formula has become known as *the abstention principle.*

The essence of the abstention principle is that where a stock of fish is being fully utilized and is under such scientific investigation, management and regulation as is required to make possible the maximum sustainable yield, then States, whose nationals have not in the recent past participated in the fishery, shall abstain from fishing the stock.

To determine whether any stock qualifies for abstention, a commission, composed of four representatives from each contracting government, reviews on an annual basis the fisheries involved and makes recommendations to the contracting governments accordingly.

The commission may also recommend to any of the contracting parties joint conservation measures in regard to any stock of fish in the North Pacific Ocean and Bering Sea, which is under substantial exploitation by two or more of the contracting parties.

The convention contains special provisions for joint enforcement in the high seas. It provides that authorized officers of any contracting party may board and search fishing vessels of any of the contracting parties and in case of violations, may seize the vessel and arrest the crew and turn them over to the contracting party to which they belong for trial and punishment.

The convention is made for period of 10 years and is to continue thereafter unless denounced by any of the contracting parties on one year's notice.

Legislation to implement the convention is contained in the North Pacific Fisheries Convention Act, Chapter 44 of the Statutes of Canada, 1953.

Interim Convention on Conservation of North Pacific Fur Seals Between Canada, Japan, U.S.S.R. and U.S.A., Signed at Washington on the 9th Day of February 1957.

The fur seal spends nine months each year at sea, three months on land. Migrating each winter to waters as far south as San Francisco on the North American

side and Tokyo on the Asiatic side, the herds, beginning in June, return to three island groups in the far north – the Pribilof Islands off Alaska and the Commander Islands and Robben Island off the Asian coast. Here they remain for three months on the beaches while the pups are born and nurtured. In September the herds leave the islands to begin their nine-month sojourn in the sea.

In the 1860's their numbers had reached almost two million, but because of indiscriminate killing of seals at sea, the herd was reduced by 1911 to about 200 thousand seals.

In 1911 the four countries interested in the exploitation of the fur seal resources of the North Pacific Ocean, that is Canada, Japan, Russia and the United States, signed a treaty under which each country agreed to prohibit its nationals from engaging in the killing of seals at sea, or as it is commonly referred to, pelagic sealing. The treaty was in effect until 1941, when the number of seals rose again to about 1.6 million. This treaty was terminated in 1941.

Because the fur seal is a polygamous creature, with mature males having harems of as many as 50 females, it is possible to maintain the herd at a desirable level by taking the surplus male population. This is done on the breeding islands by the countries having the control of the islands, at the present time the Soviet Union and the United States.

The present convention, although providing for the sharing of seal skins between the four countries in the same proportions as in the previous treaty, and for the prohibition of pelagic sealing, also provides for the establishment of the North Pacific Fur Seal Commission of four members, one from each of the signatories. It also calls for a six-year co-operative research program. As in the three Pacific Coast conventions reviewed earlier, provision is made in this convention for joint enforcement in the high seas by the four signatory governments.

Implementing legislation for this convention was passed in 1957 (see the Pacific Fur Seals Convention Act, Statutes of Canada, 1957, Chapter 31).

The International Convention for the Northwest Atlantic Fisheries Opened for Signature in Washington on the 8th Day of February 1949

The fisheries of the Northwest Atlantic Ocean have been prosecuted for almost five centuries and are closely connected with the early colonization and settlement of North America. In recent times certain fisheries of the area, particularly off the New England Coast, have shown signs of depletion.

Potential depletion of the fisheries of this area prompted the negotiation and signature of a convention by 11 countries principally interested in their exploitation. This convention, originally signed by Canada, Newfoundland, the United States, the United Kingdom, France, Spain, Portugal,Iceland, Denmark, Norway and Italy, differs from the conventions covering the Pacific Coast reviewed above in that it is an open convention and any country may adhere thereto; for example, the Federal Republic of Germany and the Soviet Union have become recent signatories of the convention.

The convention provides for the establishment of a commission on which all contracting governments are represented and separate panels with jurisdiction over defined sub-areas in which governments with particular fishing interests have representation.

The primary function of the commission is to collect and publish scientific information on international fisheries in the convention area. The commission has no regulatory powers but any panel may transmit, through the commission to the governments represented on such panel, recommendations for joint regulatory action in respect of those stocks of fish that support international fisheries. When the governments represented on the panels concerned have accepted the recommendations, they become binding on all the signatory states.

The convention was opened for signature in Washington on February 8, 1949, and came into force in Canada in 1950, following ratification by the Canadian Government. The convention was originally made for a definite period of 10 years, after which time any government had the choice of withdrawing from it. So far there have been no withdrawals. On the contrary, more countries have shown an interest in adhering to the convention.

Unlike the Pacific coast conventions, no provision is made in this convention for joint enforcement. Therefore each of the signatory governments is responsible for enforcement only in respect of its own nationals.

The convention is implemented in Canada under the provisions of the Northwest Atlantic Fisheries Convention Act, Statutes of Canada, 1954, Chapter 18.

Convention on Great Lakes Fisheries Between Canada and The United States

This convention, signed at Washington on September 10, 1954, was the culmination of many attempts to bring about a co-ordinated effort to meet the problems of depletion in the fisheries of the Great Lakes.

The Great Lakes support one of the greatest freshwater fisheries in the world. For quite some time some of the commercially important stocks of fish have been suffering severe depletion. The outstanding difficulty in taking appropriate conservation measures has been the division in jurisdiction, both international and intrafederal, over the waters of the lakes. To overcome these difficulties, the creation of an International Board of Enquiry resulted in a recommendation by the Board in 1942 of an international treaty. It took many years of sporadic negotiations before the present treaty was finally brought into force.

The convention is made for a period of 10 years and will continue thereafter unless terminated by either party on two years' notice.

A commission established pursuant to the convention, is composed of two national sections of three members from each section, whose duties are to formulate and co-ordinate research programs, to recommend to the governments appropriate measures on the basis of such research and to develop a program for the eradication or minimizing of sea lamprey populations in the Great Lakes. The lamprey constitute a major threat to the existence of some of the most valuable stocks of fish in the Great Lakes.

As fisheries in the province of Ontario are administered by the provincial Government, which also by mutual agreement enforces the federal fishery regulations in the waters of the province, an arrangement has been made between the Government of Canada and the Government of Ontario for division of responsibilities in research programs recommended by the commission.

The implementing Statute for this Convention was passed by Parliament under the name of the Great Lakes Fisheries Convention Act, Statutes of Canada 1955, Chapter 34.

International Convention for the Regulation of Whaling 1946.

Canada is a party to the several international conventions and agreements regulating whaling, the last of which was signed in Washington on December 2, 1946. The Washington Convention is based on the principles embodied in the London Agreement of 1937 and the protocols to that agreement, signed in London on June 24, 1938 and November 26, 1945.

The outstanding new feature of the Washington convention is the provision for the establishment of an International Whaling Commission composed of one representative from each contracting government. The commission is given power to amend the rules and regulations originally embodied in the Schedule to the Convention, and to recommend to the contracting governments the adoption of new ones with respect to the conservation and utilization of whaling resources.

The convention applies in all water in which whaling is prosecuted, and to all species of whales.

Most of the large-scale whaling operations are now conducted in the Antarctic. Sporadic whaling operations have, however, continued to be carried on in the northern hemisphere. Since the last war a whaling industry of considerable importance has developed in British Columbia.

The following countries are represented on the whaling commission: Argentina, Australia, Brazil, Canada, Denmark, France, Iceland, Japan, Mexico, New Zealand, Norway, Panama, South Africa, Sweden, the Union of Soviet Socialist Republics, the United States of America and the United Kingdom.

The implementing legislation for the Convention is found in the Whaling Convention Act, Revised Statutes of Canada 1952, Chapter 293.

Regulations under International Conventions

In implementing the provisions of the several international conventions reviewed above, regulations have been enacted or approved by the Governor General in Council. A list of these regulations is appended (see Appendix "B").

Conclusion

In addition to the bilateral and multilateral treaties between nations jointly interested in certain fisheries, considerable progress has been made in the last decade toward the establishment of international rules for the conservation and management of high seas fisheries which are beyond the national territorial limits and are not as such within the jurisdiction of any nation, except to the extent that any state may exercise control over its own nationals and vessels.

The crowning achievement of many years of work in governmental and intergovernmental bodies interested in conservation of high seas fisheries was the formulation by the International Law Commission of a code of Articles on Fishing and Conservation of the Living Resources of the High Seas, as part of an all-embracing code of the Law of the Sea.

These articles in their final form are based mainly on the results of the deliberations of the International Technical Conference on the Conservation of the Living Resources of the Sea held in Rome in 1955 and attended by representatives of 51 governments.

The articles were discussed at the United Nations Conference on the Law of the Sea held in Geneva in 1958 at which 86 states were represented. On the basis of the deliberations, the conference prepared and opened for signature the Convention on Fishing and Conservation of the Living Resources of the High Seas. This convention, adopted by the required two-thirds majority, gives, among other things, the right to one or more states fishing any stock of fish *anywhere* in the high seas, to make regulations for conservation purposes. These regulations would apply to all newcomers into the fishery, subject to compulsory arbitration if any dispute arose as to the necessity or reasonableness of such regulations.

The convention, while providing for freedom of fishing in the high seas subject to these articles and the rules of international law, also recognizes the special interest of the coastal state in the fisheries adjacent to its territorial waters. It accordingly allows a coastal state (also subject to compulsory arbitration in case of dispute) to adopt unilateral measures for conservation purposes in any area of the high seas adjacent to its territorial sea, provided that scientific evidence indicates the urgent need for conservation measures and provided that such measures do not discriminate against foreign fishermen; also that prior negotiation with the other countries concerned has not led to agreement. The convention is to come into force following ratification by 22 countries.

At the same conference Canada, jointly with the United States, sponsored a resolution for the adoption on a universal basis of the *principle of abstention* in situations where it could be applied, for instance, in the North Pacific where it is now incorporated in the International Convention for the High Seas Fisheries of the North Pacific Ocean made between Canada, Japan and the United States, discussed earlier in this paper. Although the resolution obtained a majority of the votes of the delegations, it failed by a few votes to get the two-thirds majority required under the United Nations Rules of Procedure.

In Canada the negotiation, revision and implementation of the fisheries treaties are the primary responsibility of the federal Department of Fisheries. The department is represented on all the commissions by one of its senior officers. It also supplies jointly with its research body, the Fisheries Research Board of Canada, the technical and expert advisers required to assist the Canadian section of each commission. Likewise, any conservation measures recommended by any of the commissions and approved by the government are enforced by the department.

APPENDIX "A"

Regulations under the Fisheries Act

Alberta Fishery Regulations	P.C.1954–1972	SOR/54–692 16–12–54
British Columbia Fishery Regulations	P.C.1954–1910	SOR/54–659 8–12–54
Manitoba Fishery Regulations	P.C.1954–1201	SOR/54–365 18–8–54
New Brunswick Fishery Regulations	P.C.1954–1908	SOR/54–657 8–12–54
Nova Scotia Fishery Regulations	P.C.1954–2062	SOR/54–728 31–12–54
Northwest Territories Fishery Regulations	P.C.1954–1626	
Newfoundland Fishery Regulations	P.C.1960–713	SOR/60–221 26–5–60
Prince Edward Island Fishery Regulations	P.C.1954–1911	SOR/54–660 8–12–54
Ontario Fishery Regulations	P.C.1954–160	SOR/54–36 3–2–54
Quebec Fishery Regulations	P.C.1954–2027	SOR/54–712 22–12–54
Saskatchewan Fishery Regulations	P.C.1954–1048	SOR/54–312 13–7–54
Yukon Territory Fishery Regulations	P.C.1954–460	SOR/54–111 31–3–54
Lobster Fishery Regulations	P.C.1957–507	SOR/57–135 11–4–57
Seal Protection Regulations	P.C.1959–724	SOR/59–191 11–6–59
Regulations for the Protection of Belugas	P.C.1954–1725	SOR/54–539 18–11–54
Regulations for the Protection of Walruses	P.C.1959–807	SOR/59–214 25–6–59
Removal of Obstruction Regulations	P.C.1954–1724	SOR/54–538 18–11–54

APPENDIX "B"

Northwest Atlantic Fisheries Convention Act	
Northwest Atlantic Fisheries Convention Regulations	P.C.1958–715 SOR/58–195 22/5/58
North Pacific Fisheries Convention Act	
North Pacific Fisheries Convention Regulations	P.C.1954–825 SOR/54–219 3/6/54
Northern Pacific Halibut Fishery Convention Act	
International Pacific Halibut Commission Regulations	P.C.1959–255 SOR/59–72 5/3/59
Pacific Salmon Fisheries Convention Act	
Fraser River Sockeye and Pink Salmon Fishery Regulations	P.C.1960–635 SOR/60–207 12/5/60
Whaling Convention Act	
The Whaling Regulations	P.C.1954–1726 SOR/54–540 18/11/54

Requirements in Fisheries Research

W.A. Clemens,
Department of Zoology,
The University of British Columbia.

Canada has been fortunate in having a program of fisheries research in operation for the past 60 years. Universities had a large part in the beginning and have maintained a fairly close association with the research program to the present day. This association should be fostered and cultivated because government agencies must look to the universities for trained young men for their staffs and for carrying out many fundamental types of research.

Detailed knowledge of the life histories of the fish and other aquatic organisms is essential in a research program. Associated with these studies are studies of the physiology, biochemistry, ecology and behavior of the animals.

Since a fish is subject directly and indirectly to all the physico-chemical and dynamic characteristics of its environment, it is essential to have a thorough knowledge of the oceanographical and limnological features of the waters.

It is essential to integrate the biological with the oceanographical and limnological information, first by establishing correlations and then by seeking explanations of these correlations. In most cases laboratory experiments will be required to help solve the problems.

Studies of the population dynamics of fish stocks are necessary for wise decisions as to the development of regulatory measures and as to the feasibility of manipulation of the stock. In the development of mathematical models, decision needs to be made as to the data required for their construction and then definite attempts made to apply them to the stocks concerned.

With those fishes which propagate in freshwater various measures may be undertaken to maintain or increase production. Hatcheries may be used to provide stock for rehabilitation of certain streams, to circumvent the lack of adequate spawning streams or to stock barren lakes. Where hatcheries are used, all procedures should be based on the known physiology of the fish. Protection and improvement of spawning beds and the construction of new spawning beds would seem to be good procedures but scientific documentation is scanty. The fertilization of lake waters does not seem to be an established effective procedure. Removal of non-game or non-commercial fish offers possibilities in certain circumstances. Here again much additional research is required.

Hybridization of fishes does not seem to be an effective procedure because of difficulty or impossibility of isolating the stock and of continuity in selection.

More basic information on the primary factors involved in the productivity of salt and fresh water is required.

It is expected that with the increase in human population and greater demands for foodstuffs, attention will be directed more and more to the resources of the ocean. Investigations of plants and animals little used or not used at the present time should be encouraged.

Parasites and disease organisms are ever present in fish populations. Research should be carried out not only on life histories and control measures but also on the factors which favor their development.

The discharges of domestic and industrial effluents are a threat to fish production and to the acceptance of a food product produced in grossly impure waters. In addition to a steady program of investigation, an educational program would help focus attention on the problems involved and the need for eliminating pollution.

High dams constitute a barrier to fish attempting to move up and down streams. A solution to the problem has not yet been found and a great deal more research is required.

Research in fish technology is necessary to ensure the best and most economical product possible for the consumer. The technologist should seek to attract the consumer by improving the quality of the fish product and in this attempt he should be aware of advancements in other food industries and be ready to adapt them to fish if advisable.

Canada today has about 200 scientists, assisted by over 200 technicians, engaged in fishery research.[1] Thus a great body of information has been and is being obtained with regard to fish and fisheries of Canada.

The problems of the fisheries are largely the result of the increase in the human population. The number of fishermen has increased greatly, fishery techniques have improved and the aquatic environment has been greatly modified, as a result of agricultural and industrial developments.[2] Examples of these developments are the clearing of the land of its forests and natural vegetation, the erection of dams, and the pollution of waters by domestic and industrial effluents. The building of canals has enabled some species to penetrate into new areas. However, as a result of various altered conditions some species have disappeared as, for example, Atlantic salmon from Lake Ontario; others have been almost eliminated as has the lake trout in the Great Lakes; and almost everywhere there have been readjustments among the fish populations.

The Nature of Fisheries Research

There may be two approaches to a problem, the one having to do with securing facts and data on which to base more or less immediate action; the other having to do with the discovery of the factors involved in the situation and the development of generalizations and principles. Government research agencies are such that much of their attention must be given to projects which require more or less immediate application; but they should attempt to carry out basic research where the results therefrom promise to have wide value in application.

Canada is entering a new era in fisheries research. Investigations began with a survey of species, their distribution and the foods they consume, and were afterwards extended to estimates of the size of fish populations. When pressure on the stocks increased, following intensification of fishing and changes in environmental conditions, there were often extreme fluctuations in fish populations. Management measures had to be devised, and these measures were often taken in haste and without the benefit of factual information.

Most fishery problems call for a more analytical type of approach that gives emphasis to the individual fish and its environmental relations, its physiology and biochemistry, its behavior patterns, and the physical and chemical conditions of the waters which it inhabits. Knowledge of the dynamic interrelations between the fish and its environment will greatly help the fishery biologist in predicting the results to be expected in certain specified circumstances.

The first requirement in fisheries research is for a goodly supply of men with broad scientific training, vision, imagination and enthusiasm. As Dymond has pointed out, many research fields in Canada have had to face, in recent years, a shortage of well-trained young research workers, and, the supply was distributed over many fields. Moreover, fishery organizations have tended to waste some talent by too often assigning highly qualified research men to more or less routine projects or transferring them to administrative positions. True enough, fishery organizations need men with ideas and qualities of leadership and with broad scientific background for administrative duties; these men are usually outstanding as research workers. This situation is perhaps inevitable in a young and expanding country where the supply of such men is limited.

Fishery organizations must maintain and develop a close association with universities. In the past they have conducted investigations along conventional lines, have been slow to install experimental laboratories and unenthusiastic about investigations of a long-term character. Fortunately, in recent years there has been a move toward closer co-operation between fishing agencies and universities; this should be fostered and encouraged by all means possible.

The agencies look to the universities for trained men; they have many fundamental problems which they find impossible to deal with because of limitations in size of staff and other considerations. It would seem advisable for representatives of both organizations to meet and discuss ways and means for using graduate students and faculty members in carrying out many researches. Such a co-operative program would be of mutual benefit.

Requirements in Fisheries Research

Life Histories

Fundamental research includes studies of the life histories of the fish, spawning, incubation, foods and growth, movements and migration, predators and diseases and mortalities at all stages. Associated with these studies are studies which are perhaps more concerned with interrelations between the fish and its environment, – physiology, biochemistry, ecology (relations to physico-chemical factors), sociology (relations with other animals), and behavior.

In these days of changing environmental conditions, the need for research in this field is pressing. For very few of the commercial or sport fishes in Canada

is all the required information available to make the wisest management decisions.

Oceanography and Limnology

A fish lives in an aquatic medium and is subject to all the static and dynamic features of that environment. To understand every phase of its life, it is necessary to know the chemical composition and the physical features of the waters; the daily, seasonal and long-term changes; the influence of land drainage; and the movements of water masses. The fishery biologist must look to the oceanographers and limnologists for the information required for the interpretation of the biological observations and data. One difficulty in the past has been the lack of knowledge of the interrelations between the physico-chemical features of the environment and the biological phenomena. A much closer association should be established between the physico-chemical oceanographers and limnologists and the fishery biologists to attain these objectives. Fortunately this situation is being rapidly corrected through the establishment of Institutes of Oceanography on the Pacific and Atlantic coasts, so that fishery students may have an opportunity to learn the basic principles of oceanography and become oceanography-minded.

The great need is to establish correlations between oceanographical and limnological data and biological information and ultimately to determine the reasons for the correlations. Fishes in the course of evolutionary development have become adjusted to environmental conditions so that their life processes are carried out within certain ranges of temperature, salinity, light and other physical and chemical conditions. Every phase of the life history is involved. For example, spawning, incubation, growth, movements, migration, physiology and ecology are related to temperature, light, salinity, current, and other factors. The physiological processes, along with the cycle of changes within the fish and the seasonal and other changes in the water, should be known to understand the cycle of oceanographical and limnological events which produce such things as migrations, habitat preferences, rates of growth, mortalities and various features of behavior. In addition to field studies special investigations must concern themselves with fish maintained in tanks where conditions may be varied and controlled.

Essential to all fishery management is a knowledge of the productivity of waters. What parts of the ocean are most productive of life and what factors or combination of factors make them so? What factors make some lakes more productive than others? What seems to be needed is a fundamental study of the relations of light, winds, movements of water masses, amounts of chemical constituents and all the factors and combinations which result in a high production of phytoplankton. Such a study is underway in marine waters but little research has or is being carried out in fresh waters.

Population Dynamics

Fundamental to fishery management is a knowledge of the numbers of fish in the stock concerned. The size of the population of any species of fish varies over time. It may reach a fairly large size in particularly favorable conditions, and decline to a low level in adverse conditions. It is necessary, from year to year, to discern the fluctuations or trends and to decide what, if any, measures should be taken to maintain the stock at a given level.

An estimate of the size of the stock of any commercial and game fish is essential to proper management. Information on the amount of catch which may be permitted and the most economical age or size of fish to be harvested annually would also be of great value to fishery authorities. It is difficult to obtain information on the cod in the northwest Atlantic, because the people engaged in the fishery belong to so many different nationalities. On the other hand, fairly reliable information is available for the halibut of the north Pacific and the whitefish of Great Slave Lake.

The construction of mathematical models is a procedure worthy of consideration but full advantage cannot be derived from its application because a) the lack of adequate data often makes it necessary to introduce assumptions, and b) the required mathematical treatment is often beyond the understanding of non-mathematicians. What we have to do, then, is a) to reach decisions as to the types of data required, b) to set up procedures for collecting these data, c) to provide qualified personnel to analyze the data and keep records up to date, and d) to apply the results to management procedures.

Changes in fish populations are attributable to many causes. Research work will give us the knowledge required to make reliable forecasts and indicate to fishermen where the fish are, the sizes of stocks and of fish, the movements and migrations of fish populations and the reasons for the application of regulatory measures.

Considerable attention has been given to populations on the Atlantic and Pacific coasts of Canada

but little has been done about the fishes of the Great Lakes, partly because of divided international jurisdiction. In the early days lake trout, whitefish and ciscoes were the primary commercial fishes of the Great Lakes. Later, walleye, yellow perch and other species came into demand. In recent years a very decided change has taken place. Additional species appeared and possibly the development of the Welland Canal was a factor in the spread among the lakes. One of these, the lamprey, became very abundant, fed on the lake trout and practically eliminated this species commercially. At the same time smelt and alewives entered the lakes, and became very abundant, while the whitefish and cisco populations declined. The whitefish may have suffered from lamprey depredations but some of the declines in fish populations may stem from competition for food. The walleye populations in Lake Erie have decreased for reasons which are not clear, but it has been suggested that pollution and higher water temperatures may have had something to do with the decline.

A great deal of effort and much money were spent on the control of the lamprey, particularly in Lake Superior. In cases of invasions of new territories by various species, the invaders have increased enormously in numbers but, after exploiting the new area, have settled down as a part of the general fish economy. Whether or not the lamprey will follow this pattern remains to be seen. At any rate, attention should be given to the future. With the reintroduction of lake trout, it is doubtful if they will ever reach their former population levels while remnants of the lamprey population remain in the lakes and new stock may enter through the Welland Canal. An introduction of selected hybrid splake (a cross between the lake trout and the speckled trout) will be made and the results will be watched with great interest. Suggestions have been made for the introduction of Pacific chinook salmon and for increased liberations of rainbow trout, but it may be pointed out that these are salmonids and probably subject to attack by the lamprey. The success of possible introductions may depend on the ecological and sociological distributions of the various species.

An international commission has been established for the study of the fisheries of the Great Lakes, as a preliminary step in dealing with the situation. There is now needed a mobilization of the financial and facility resources of the States bordering the lakes, and the Province of Ontario, with the assistance of the federal Canadian and United States governments, to attack the problem on a broad basis. Knowledge is required of the life histories of the various species, their spawning requirements, reproductive capacities, foods, populations, interrelations among species, and the physical and chemical characteristics of the waters. If it is decided that the lakes must continue to support large populations of smelt and alewives, the question of their use must be decided. The problem of the Great Lakes offers a real challenge to governmental authorities and fishery biologists and limnologists.

Fish Culture

With very many changes in the environmental conditions and a great increase in the number of fishermen, the number of fish per fisherman has been decreased. The question arises as to what measures may be taken to maintain or increase the production of fish.

It would seem that nothing can be done at the present time in regard to ocean fishes other than attempt to regulate the catch on the basis of numbers of fish in the population.

In the case of fresh-water fishes, experience and scientific studies over a period of about 100 years indicate that hatcheries are not the answer to the general problem of how to increase fish stocks. The advantages of artificial over natural production, where conditions for natural propagation are reasonably good, are not significant enough to justify the effort and costs required in hatchery operation. In some instances sheer numbers are an obstacle. For example, to replace natural with artificial propagation of sockeye salmon on the Fraser River would involve nearly two million fish and about three billion eggs annually. Later, many millions of young sockeye would have to be held for a year in fresh water and provided with sufficient food. Hatcheries may be used effectively in initiating the rehabilitation of certain streams and in circumventing certain unfavorable local conditions such as lack of or poor spawning streams. They may also be used to produce eggs or fry for stocking barren lakes.

Where hatcheries are to be used, every effort should be made to ensure that they are used efficiently and scientifically. Each procedural step should be based on the known physiology of the fish. For example, it would seem that troughs or circular tanks used for holding fry should be provided with baffles so that the young fish need not *fight* the strong current 24 hours a day. By providing rest places more food would go into growth and less into expenditure of energy. Further, in all handling of fish over-expenditure of energy and excessive excitement should be

avoided, especially in liberation procedures. Research should be carried out on the relative efficiencies of the stacked-tray and trough methods of handling the eggs.

Considerable promise seems to lie in the improvement of spawning beds and in making artificial spawning grounds. Several experiments are now underway and it is hoped that a thorough check will be made of these efforts so that adequate data will be available for a scientific assessment of the results.

Another measure is the installation of flood control dams which would prevent flash floods and store up waters resulting from the melting of snow and ice and from heavy precipitation, for release at other times. On salmon streams enough water would need to be stored to provide for spates which would cause the salmon to enter the stream and to take the young salmon down to sea. Further, dams should not be of such a height as to prevent adequate arrangements for the passage of salmon up or down stream and should be under supervision of a scientist to ensure the proper time for release of water. For species inhabiting streams, there would need to be enough stored water to provide a sufficient amount in the streams in mid-summer. In many cases rehabilitation of sport fishes in streams will depend on natural or artificial reforestation of the stream course. All the factors in the problem of storage dams require investigation.

Two measures aimed at greater production of game and commercial fish have been in use but neither has had sufficient rigid scientific treatment. These procedures have been the fertilization of lakes and the removal of non-desired fish, chiefly by poisoning. Both require continuous application and are limited to small bodies of water. Fertilization has many serious limitations and requires a great deal more research work to establish general effectiveness.

Removal of non-desired fish should help increase numbers of game fish, by leaving more food for the game fish. The removal of predatory species, particularly, would seem to be a good procedure and, in one instance it has been carried out on a scientific basis and showed positive results. Research might be undertaken to discover poisons which would be specific for particular species. It would then be possible to remove a single species from a lake and observe the results. The interrelations among fish populations are complex and until more research work is done removal of non-desired fish will have to continue on a rather haphazard basis.

What is needed in each procedure is a reasonably long-term program of investigation which begins with a thorough assessment of fluctuating conditions before the experiment and follows with an accurate scientific measurement of the results.

Genetics

The improvement of fish strains through hybridization is a matter that should be studied critically as to feasibility, desirability and economic costs. For ocean fishes with large populations there does not seem to be any method by which hybrid or improved strains can be isolated and their characteristics maintained. Any strain produced in isolation at a hatchery and liberated among a natural population will interbreed with this population and eventually be lost. Every animal is a combination of a very large number of unit characters. When man wishes to establish a new strain he decides on which characteristics are desirable and then selects individuals having these features, breeds them among themselves, selects and breeds continuously. As soon as he allows interbreeding to take place with other stocks the purebred line is lost. Selective breeding does not appear to be a method for solving the practical problems of the fisheries except where man or nature kills off those fish having the original, non-desired characters and preserves those fish which have the desired features. An attempt is being made to establish a selected breed of splake, a hybrid between the lake trout and the speckled trout, in the Great Lakes. If the lamprey continues to kill off the lake trout there is a possibility of success for the splake. The results will be watched with interest.

Future Utilization

With increase in human population, a much greater demand for food supplies may be anticipated. Further exploitation of the resources of the sea may be looked for as well as the intensification of fishing of presently used stocks. Studies should be made on the life histories, distributions and populations of many fishes not now used or little used; of many marine invertebrates, including squids; of seaweeds, whales, seals and sea lions. The utilization of plankton for the preparation of soups may be envisioned when areas of high production are delineated.

Parasitism and Diseases

Fish parasites have been a serious economic problem in the marketing of fish.

On the Atlantic coast the nematode, *Porrocaecum,* in the cod has been under study for some years and no easy solution seems to have been found for its control. Filleting and candling of the cod seem to have partially met the marketing problem. Continued research may provide an answer.

In the western provinces the tapeworm, *Triaenophorus,* has provided a somewhat similar problem and again filleting and candling, together with avoidance of fishing in heavily infected lakes, have met the immediate circumstances. Since pike carry the adult parasite a solution of the problem would be attained by the complete elimination of the pike. The Fisheries Research Board has demonstrated that by strenuous and continuous removal of pike from a lake the population may be reduced to a point where *Triaenophorus* infection is negligible. Whether such a procedure is applicable throughout the western provinces or not is another matter into which economics enters. A second procedure, employing chemicals to kill off the free-swimming larvae of the tapeworm, has not yet met with success but is a field for continued research.

Protozoan parasites, particularly in hatcheries and ponds, have caused serious losses in hatchery stocks and are always a threat in hatchery practice. Bacterial diseases are likewise a bane. Investigations on the origins of these protozoa and bacteria, the factors favoring their development in epizootic and epidemic outbreaks, and their control are essential for artificial propagation.

Pollution

By pollution is meant the placing in the waters of foreign substances which are poisonous, deleterious or a nuisance to fish as well as to man and his industries. A great deal of research has been and is being conducted and it would seem that although research must continue, a stage has been reached where education and money are now required. It is generally realized that with increasing human population and industrialization our waters must be kept clean for fish production, domestic purposes, recreation and industrial uses. It is against the law to use human excrement for the fertilization of vegetable crops and it should likewise be against the law to use this material for the fertilization of the waters.

The matter of taking care of effluents is pretty well understood but new kinds of materials are being released constantly and new types of research are required. Municipal sewage disposal plants are difficult to finance, but once installed the costs of operation may be partially met by sale of recoverable materials. Industrial procedures will have to have their costs absorbed by the industries concerned. Two special pollutants need to be referred to. Discharge of sewage from vessels into fresh waters and coastal waters should be prohibited. Investigations should be made as to the feasibility of installing disposal structures in vessels and as to places for discharge. Another pollutant which will become of major importance is the waste from atomic plants. Some preliminary research has been done but the disposal in the future of large quantities of this material will require much thought and ingenuity.

Dams

In the early days of settlement in Eastern Canada dams were quickly built for the development of power to grind grains and to saw logs into lumber. Most of the dams were not high but they lacked fishways and so were blocks to the ascent of shad and Atlantic salmon in the rivers. In view of the experience on the Atlantic coast, dams are being erected on the Pacific coast of Canada at the present time only on streams which have no or few salmon and research work is being carried out to find adequate means of passing large numbers of adult fish upstream and young fish downstream at dams. The fishery biologist has been greatly handicapped through lack of knowledge of the physiology and behavior of the fish in various environmental conditions. There is need for more knowledge of the individual fish in a dynamic environment. At the same time consideration should be given to research on the guidance of smolts and adults by odors, on designs of turbines and on large mechanical devices for passing adults and smolts over dams. Further research is needed on the utilization of their energy reserves by fish and their capacity to endure fatigue.

Technology

Many trends may change the demand for fishery products but fish technology must occupy a prominent part in fisheries research to produce a desirable product through the best and most economical methods of catching, handling and manufacturing. So long as *wild* aquatic forms are harvested there is scope for much technical investigation and it must be a forward-looking program. It must anticipate changes in the demands for fishery products and seek new and ever better forms to compete with other foods. The following are some of the lines for study:

(a) *Harvesting* – Fast, efficient vessels equipped with machinery for quick and easy handling of gear;

multi-purpose fishing vessels; light but strong fishing gear; electro-fishing; mother and factory ships; pumping and sluicing to avoid bruising of catch.

(b) *Transportation of the Catch* – Transport from place of catch to shore and thence to reasonably distant towns and cities; the use of narcotizing agents in such transportation; the transport of dead fish by various techniques; the use of aircraft, including the helicopter; better application of the known principles of refrigeration; research on the effects of pre-capture struggling, onset of rigor mortis and other factors on the quality of the frozen product.

(c) *Preservation of Quality* – Rapid transport of fresh fishery products under proper conditions and prompt marketing should obviate the need for preservatives but should exigencies require their use, safe preservatives may be developed. Other means not yet perfected for protecting fresh fishery products against quality deterioration are radiation, pasteurization or sterilization, ultrasonic vibration.

(d) *Canning* – Research on seamless (except for lidding) aluminum cans points to more general use of this container. In the future this may be replaced by a plastic package of fresh or frozen fish sterilized or pre-cooked by electric inductance heating.

(e) *Freeze-drying* – Recent results with dehydrating meat for indefinite storage at room temperature until reconstituted with water to produce a product approximating fresh meat show promise of application to fishery products. Further research for antioxidants or other means of protecting dehydrated fatty fish during storage will be necessary. Further research on the production of fish meal and fish flour is desirable.

(f) *Pharmaceutical and other chemicals* – The search goes on for the discovery of new organic chemicals for medical and related uses. Biochemical research on migrating Pacific salmon has recently disclosed the function of certain fish hormones, steroids, unsaturated fatty acids, enzymes, and other constituents. Characterization of some of these indicates that until they are available as synthetics further research on their production, from fishery materials for medical and nutritional uses, and on their functions in the living animal will be called for.

The foregoing are only a few of the types of research that may have significance for tomorrow. Research work should be primarily designed to lead to a more efficient production of fish products of better quality. The technologist should be alert to the adaptation of techniques developed in other branches of food technology.

FOOTNOTES

[1] Dymond, J.R., *The Organization of wildlife and Fisheries.* Research paper prepared for the 1961 Resources for Tomorrow Conference.

[2] Larkin, P.A. *The effect of Man-Made changes on the Environment of Fishes.* Paper prepared for the 1961 Resources for Tomorrow Conference.

Information and Extension Work in the Atlantic Fisheries

A. F. Laidlaw,
National Secretary,
Co-operative Union of Canada,
Ottawa, Ontario.

Public understanding and knowledge of Canada's fisheries are essential to the development of the resource for the benefit of all and for the prosperity of the people who depend on the fishing industry for a living. The three groups which must be informed and educated are made up of the fishermen themselves, the consuming public, and all those in the industry between the two.

At the end of World War II Canada's fisheries were 30 years behind agriculture in research, scientific and technological development, marketing methods and general outlook. Since the war there has been a change in attitude toward the fisheries. The need for a program of technical and vocational education for fishermen is now recognized; co-operative organizations have emphasized the need for increasing fishermen's productivity; processors welcome inspection programs which will improve the quality of their product, and administrative bodies are aware of the need to educate consumers in the value of the resource from an economic standpoint and as a source of much-needed food. Despite the improvement the fisheries are still behind, partly because of the phenomenal advances made in agriculture in the past 15 years.

Techniques and programs for information services and extension work in fisheries have to be developed along new lines, and reluctance to accept the findings of research must be overcome. Extension and educational work must be kept separate from the policing of the fisheries; the latter might well be handled by the R.C.M.P. or a special force. The best educational approach can be made through groups, by dedicated people in the field.

Special attention must be given to the publication of material dealing with the fisheries, and the results of scientific research must be translated into language that can be understood by the people for whom they are written.

In addition to publications of many kinds, greater use of films and filmstrips, radio and television will be necessary, and technical and vocational schools are needed to train personnel for the fisheries, somewhat along the lines of agricultural colleges. An Atlantic School of Fisheries at Halifax, for instance, closely associated with various government research agencies and other services, could provide an intellectual home and help create a culture and develop an improved technology for the people identified with the fisheries resource.

The transmission of information about fisheries, that is, the flow of facts and ideas to people, especially to certain groups of people for whom the fisheries resources are a source of livelihood, is a matter of importance for the Canadian people.

Useful information and scientific knowledge tend to lie unused in academic and official repositories. We want to see how this information and knowledge can be brought out and put to work most effectively in the lives of people, and in the service of the nation and humanity. This is *extension work.*

The diffusion of information and knowledge may be compared to the distribution of electric power. It is generated at a source of great potential and from there sent across the country by transmission lines, then over secondary lines, stepped down by transformers and finally put to work at a lower voltage in a hundred ways in home and factory. In the realm of knowledge and ideas there must also be transmission lines, secondary lines, transformers and connecting lines. That is the concern of this paper — to examine the transfer of knowledge from where it is generated to fishermen and other workers in the fisheries, to processors and personnel in commercial organizations, and also to the public.

Though the fisheries industry is a comparatively minor one in the total national economy, it is important in the lives of the people and the communities depending on it. If properly developed, the fisheries could be a decisive factor in the economy of parts

of the country that tend to be economically depressed. Moreover, the consuming public and a hungry world also have an interest in the fisheries. In short, since the human element looms so large all the way from fisherman to consumer, the educational implications of the industry are of first importance.

Some Observations on the Fishing Industry and its Past

The fisheries were, until recently, an unprogressive and neglected industry in Canada. While people found a certain appeal in the sea, in the quaintness of the fishing village and in ships and fishing craft, they were not generally aware of the retarded development of the fisheries or the social implications of both neglect and exploitation in this sector of the economy.

The early approach to the industry tended to be primitive, much behind the agricultural industry, for example, in most respects. The fishery, like the forest industry, suffered from the lack of scientific attitude on the part of most people engaged in it. Just as the first settlers in North America often tended to look on the forest as a sort of enemy that stood in their way, to be attacked and cut down, so also the first generations engaged in the fisheries proceeded with utter disregard for conservation or the scientific development of resources. They regarded the wealth of the sea as inexhaustible, and so tended to resent any restrictions on their freedom to fish as they willed. This attitude almost resulted in disaster in the lobster industry, for instance, reducing the catch on the east coast from an estimated 100 million pounds in 1885 to about 27 million pounds in 1918. The same neglect contributed to a drastic reduction in the size and value of the Atlantic salmon industry.

This neglect of the fisheries was to a considerable extent reflected in the government services of the time. While the federal Government did something with regard to protection, inspection and biological research, provincial governments disregarded almost completely the industrial aspects of the industry and were quite unconcerned about educational programs for the development of the fisheries. The fisheries department was generally considered an unimportant one in former days, and it was often difficult to recruit the right kind of personnel for this branch of government. One aspect of this neglect by government was the lack, until recently, of reliable fisheries statistics.

Nowhere was neglect of the industry more clearly reflected than in the lives of the people who lived by fishing. Fishermen frequently found themselves at the lowest end of the economic scale, and in comparison to farmers were a generally depressed, exploited and ill-informed people. In fact, the fishing village was about the only place where feudalism of a sort got a serious foothold in the new world. A strange anomaly had developed: that an industry of great potential wealth for the Atlantic provinces often supported the poorest class of people and the most backward communities.

The methods and techniques of the fisheries also tended to lag behind and remain unchanged over many years. The industry took little note of research and resisted the changes recommended by scientific investigation. Too often, moreover, the product reflected the general backward condition of the industry. Some forms of fish products remained unimproved for a long time, and quite often these products were not of the better grade required by the market. Improvement of quality came slowly, and measures of inspection tended to be scoffed at and rejected by the commercial interests in the fisheries.

Under such conditions the industry never attained the commercial level that it might have reached. A prosperous and expanding fishing industry was let go by default. While other nations took advantage of the great resources of the Atlantic waters adjacent to Canada, less than 10 per cent of the fish taken from these waters went into Canadian vessels.[1]

Parallel to these conditions, little or no attention was paid to the educational side of the fisheries; no educational institution was developed to serve the special needs of the industry. The school system seemed to pass by the fisheries altogether; no program of technical or vocational education for fishermen was thought necessary.

Change and Improvement Come

The industry reached a turning point during World War II or shortly after. About 15 years ago, a more scientific, modern, and optimistic outlook began to characterize the fisheries and considerable progress in most respects has been made since then.

Governments began to take the fishing industry more seriously and to direct more funds to its development. Provincial governments, which had previously done next to nothing for the industry, began to set up fisheries divisions and to develop programs for the benefit of fishermen and for the improvement of industrial plants. Government departments began to attract better trained and better qualified personnel. More attention was given to technological as well as biological research. Better plants, representing greater capitalization of the industry, began to be built.

Moreover the economic conditions of many fishermen began to show great improvement. More emphasis was placed on increasing the productivity of fishermen rather than on palliative forms of assistance. Fishermen's co-operatives began to build more strength, providing services for members not only in

marketing and supplies but also to some extent in credit and insurance.

This new era in the fisheries was also marked by a changed attitude toward inspection. The need for supervision and government inspection became more widely recognized. Many plants ceased to resist measures of inspection, and producers of superior quality products especially began to recognize the positive values of inspection in the marketing of fish. And although in some areas the attitude toward protection showed little improvement, there has been of late years a growing appreciation of the fisheries as a great natural resource to be studied and scientifically developed.

The need for more reliable and detailed statistics also became recognized, and fishermen and processors alike are now readier than in former days to assist in the compilation of statistical information that will give a more accurate picture of conditions and progress in the industry.

There is a greater awareness of markets. The federal department has developed a consumer service division with home economists to stimulate the buying of fish and to instruct in its best preparation for the table. There is a growing appreciation of the food value of fish, and new forms of fish are finding popular acceptance.

Education has also begun to find a place in the fisheries. It is recalled that the MacLean Commission (1928) had this to say on this subject:

> "All the fishermen who appeared before us emphasized the necessity for technical education and instruction... fishermen on the whole are now ready willingly to receive any instruction, theoretical or practical, designed to benefit the fishing industry. We cannot therefore agree with the ideas sometimes expressed to us that fishermen as a class are so attached to old methods that they would refuse to accept instruction in new and improved processes to meet the consumers' standards and requirements.. a practical system of education would be regarded with sympathy by fishermen... What has been done for agricultural education by the Agricultural Department is an interesting example of what might be done for fishery education. We strongly recommend that adequate assistance be authorized for fishery education in the Maritime Provinces...[2]

A good start in the direction of this recommendation has been made. Provincial governments, the federal Government and various educational institutions have taken up fisheries education, and the idea that education has an important function at all stages in the industry from the fishing grounds to the market place is now little opposed. One of the most hopeful features of the present educational programs is the generally good collaboration between federal and provincial bodies in this work.

New techniques of information and education are now being tried with good results. The Information and Educational Service of the federal Department of Fisheries is exploring new channels of education and communications, using films, film-strips, radio programs and attractive publications and posters.

The educational approach is now being used in the area of conservation and protection, for example with lobster fishermen. For a minority of fishermen and processors the approach through police officers will still continue to be the only effective way to enforce protection of resources, but for the majority educational methods will always show better results.

To summarize, it may be said that the fisheries are no longer an altogether forgotten and depressed industry. From the viewpoint of education the implications of this change are important, for information and extension activities can now be directed along more progressive and positive lines. The purely palliative kind of extension program need no longer be the dominant type, and education can now be carried on in an atmosphere which is not so charged with defeatism as in days gone by.

Certain Features of the Industry as a Result of Historical Development

The fisheries still must overcome a great backlog of neglect and unprogressiveness, and this fact is of special significance to educators and extension workers.

It is safe to say that at the end of World War II the fishery in Canada was at least 30 years behind agriculture in research, scientific and technological development, marketing methods and general outlook, including knowledge and use of resources. Nor have the fisheries been able to catch up to the phenomenal advance of agriculture in the years since then.

Moreover, there has not yet developed the same sort of relationship between government and fishermen as has obtained between government and farmers for more than a generation. The extension worker in agriculture (the *ag rep*) has long been regarded by the farmer as a counsellor and friend. The fisheries officer (note the connotation of the word *officer)* is more likely to be regarded as a sort of policeman. The agricultural worker steps easily into the role of educator; it is more difficult for fisheries personnel to do so – which leads us to the suggestion that for best results the functions of enforcement and education should perhaps be quite separate.

Nor do fishermen consider themselves in quite the same light as do farmers – as food producers, or in relation to food supply, or as participators in the na-

tional economy. Fishermen are less inclined to organize in associations.

The very nature of the fisherman's occupation has made him in some respects a different kind of producer from the farmer. In contrast with farming, fishing is a more venturesome and often hazardous occupation, requiring certain personal skills in which fishermen have always taken great pride. The element of uncertainty in production has tended to focus attention on luck and good fortune, rather than scientific knowledge, and because of this fishermen traditionally think of the catching of fish as the only job of much concern to them. It is perhaps because of this that many people believe that fishermen do not take to organization and group action as readily as farmers. Whatever the reason, it is likely that information services and extension work in the fisheries will have to develop their own techniques and programs especially designed for the industry and its people.

And though the years since the end of the war have seen a considerable change in attitude, the fishing industry still has a predisposition to conservative thinking that extends beyond the line of ordinary caution, an inertia that makes the Canadian fisheries far more conservative, for example, than the American industry, though the Pacific fisheries in Canada tend to be much less conservative than the Atlantic. Specialists in fisheries in Canada report that, though there has been much improvement in the last decade, there is still undue reluctance to accept the findings of research, and this goes not only for fishermen but also for processors, business managers, distributors and exporters.

The industry continues to be over-cautious about capitalization, especially on the Atlantic coast. Canadians, it would seem, tend to be misled by the bounteous riches of the sea at their door, which they have always considered their own, forgetting that the resources in which nature gave them a decided advantage by virtue of geography must be matched by investment and plant and industrial capacity. The fish are not ours unless we are prepared to capitalize industry and develop great human resources to take care of them.

The gist of this section is a warning against complacency. The progress of the past 15 years has been considerable because the industry started with a low benchmark. The future holds much promise because we have so far to travel yet in research, inspection, industrial development, marketing and in the economic improvement of fishermen and of fishing communities. All of which means that the field of education, training, information and extension work in the fisheries offers great opportunities for the future.

Extension Work in the Fisheries

Extension work helps people through education to attain a better standard of living. Two key words in extension work are *people* and *education*. It is, obviously, closely associated with understanding of environment and the intelligent use of resources.

For guidance in extension work in the fisheries, we have long experience and abundant literature in agriculture to draw on. One authority describes it thus:

> "The philosophy of extension work is based on the importance of the individual in the promotion of progress for rural people and for the nation. Extension educators work with people to help them develop themselves and achieve superior personal well-being ...Progress varies with individual needs, interests and abilities. During this process the whole community improves as a result of co-operative participation and leadership development. There are signs that some of the more general social objectives may be reached. After years of consistent work we dare to point out progress in better citizenship, democracy and appreciation of science. The extension worker who understands this and keeps this philosophy as his fundamental objective will approach his work as a teacher with adequate perspective and will have a permanent influence on the situation in which he finds himself. This philosophy of extension work thrives best in the man or woman who holds a deep concern for the well-being of all mankind and an abiding faith in rural people and their ability to develop..."[3]

In the fisheries there are three well defined groups to reach and provide with information and educational services:

(a) *Fishermen.* They are the beginning and foundation of the industry. The best use of resources starts with them. They can no longer depend on traditions and intuition, but must be trained in the science of the fishery just as the farmer in agriculture. Nor can the fisherman's training be considered complete and final at any point, for modern progress and technology call for constant education. Extension services must, therefore, be thought of in terms of continuous adult learning, especially in the knowledge of resources and the latest methods and techniques of fishing.

(b) The second group is what may be termed the *marketing group.* In this group are all those who handle the fish between the fisherman and the consumer – processors, plant personnel, distributors and exporters. Included are the business and commercial interests, both private firms and fishermen's co-operatives. This group has much to do with matters of inspection, quality control and the economics of the industry. The need and opportunity for educational services with this group are, of course, great.

(c) Education must also be directed toward the *consuming public,* and this area too offers unlimited possibilities for information and extension work. It is common knowledge that many of the past ills of the fishing industry stemmed from disregard of the consumer.

Certain fundamental principles of extension work have particular application to the fisheries and the development of its resources:

(a) The key to success in extension services is the use of the educational approach. Those who are engaged in this work must, first of all, be regarded as educators, not simply government officers or purveyors of cold information. People must learn; they must adopt new attitudes as the result of the educational process. For this reason it is strongly recommended that the extension and educational services be separated from policing of the fisheries, perhaps to be done by the R.C.M.P. or a special force. In law enforcement the objective should be democratic responsibility through education for the majority who are law-abiding citizens, and coercion by police action for the minority who will not observe necessary regulations.

(b) The best use and development of resources must be based on a sense of ownership. People are not going to value natural resources or conserve them when necessary unless they feel that the resources are theirs. This feeling of ownership must be developed in two ways: from the personal and perhaps selfish viewpoint of financial gain, and also from a sense of public trust. In the case of the Atlantic lobsters, for example, fishermen are not going to follow conservation measures unless they see the financial benefit of doing so and also understand that they are custodians of a source of great potential wealth.

(c) The third principle in extension services is that educational progress is best made through a group. Educational services are not only more economical but also more effective when channelled through groups and organizations rather than individuals. This principle goes for all three - fishermen, the marketing sector and the consumers. In protection, for example, the most effective control over the individual fisherman often comes through his co-operative society. In inspection, the contact through a trade association can generally bring quickest results. And the consumer can also be most effectively reached in the group, for example, in women's organizations and with TV programs.

Methods and media should be appropriate to the information being transmitted and the people being taught. Most important of all is the right type of fieldman or educational worker. Agriculture all over North America has trained a body of fieldmen with certain qualifications and attitudes that have left a strong impression on rural life. The ideal field worker in extension is a competent, well-trained, but above all dedicated person. He (or she) is distinguished by a love of people and of working with people, and by tact and thoughtfulness in dealing with people. He works for a cause rather than at a job. The fisheries service must build its corps of such workers, and of course already has some to start with.

Special attention should be given to the publications needed. There is a wide gap between the scientist and the specialist on the one hand, and the fishermen or plant personnel on the other. The scientist does not usually write with the fisherman in mind. The extension service must put the writings of science and research in the language of the person at the other end of the communications line.

Greater use should also be made of films and filmstrips in this work. The possibilities of radio and TV as educational media in the service of the fisheries are very great.

A Cornell University study of extension work (7) revealed a number of useful guide lines. From them we may say that extension work in the fisheries:

- should be based on conditions as they are (local, regional, national).
- should involve people in actions that promote their welfare.
- should develop programs gradually.
- should aim basically at people's interests and needs.
- should use democratic methods.
- should keep programs flexible.
- should work through understanding of the culture.
- should use local leaders.
- should use existing local agencies.
- should utilize trained specialists.
- should work with all members of the family.
- should make programs as broad as the needs of rural people.
- should evaluate continuously.
- should work with all classes of society.
- should keep in line with national policies.
- should use the community approach.
- should help people recognize their needs. (7)

Need for an Educational Institution for Fisheries

We can hardly imagine Saskatchewan without an agricultural college, yet it is an amazing fact that the Atlantic provinces have no educational institution based on the fisheries resources and the fishing industry. Norway has six technical and vocational schools to train personnel for their fishery. Nova Scotia has an excellent agricultural college but no similar institution for its fishery.

93452—54½

It means much more than providing technical and vocational training, although of course this is very important. But in addition to training the personnel required, an educational institution builds an *esprit de corps* and creates a culture for the people identified with the industry. This is what an agricultural college does for farmers, for the civil service of agricultural departments and for the agricultural industry generally. The Canadian fishery on the Atlantic coast has no such centre of learning; it needs an intellectual home, a campus of its own. In Quebec, such a centre has been operating for some years at Ste-Anne-de-la-Pocatière.

There should be an Atlantic School of Fisheries. It should preferably be a joint undertaking in which federal and provincial governments and the universities of the region will together provide an institution of technical training and higher education in the service of the Atlantic fisheries.

The best location for it would be Halifax, where it could be closely associated with the technological station of the Fisheries Research Board of Canada, the Nova Scotia Technical College, the School of Oceanography and various government services. In this School of Fisheries could be concentrated all the various training and extension services now offered by government and universities in the fisheries. A single governing council drawn from all the co-operating bodies would ensure an integrated educational program, the most economical use of available funds and imaginative leadership under highly competent experts in the fisheries.

Such an institution need not, of course, do all its training or educational work on the campus. The courses now being given in various places by the Nova Scotia Fisheries Division would be continued, as well as the course conducted in French at Caraquet for N.B. fishermen. But all such courses as well as extension services would be co-ordinated through one authority in the School of Fisheries. We believe that all who are concerned with the future of the Atlantic fishery should join hands to give it the intellectual leadership that such an institution could provide. Governments should be especially interested in establishing such a school for it would be the training centre from which their personnel would be recruited, just as agricultural departments today draw their men from the various colleges of agriculture across the country.

Conclusion

This paper is written with the Atlantic fisheries principally in mind, but its observations can be applied with certain changes to the Pacific and inland fisheries as well. Its main theme is that the resources of the fishery, as with other forms of natural wealth, should be developed for the use and benefit of all, for the prosperity of all people who are engaged in it, and that the only way to achieve this is through understanding and knowledge. For too long the fishery was permitted to languish in backwardness and unscientific attitudes. Its future prosperity and vigour must be based on greater enlightenment and widespread education.

If we are seeking a criterion for measuring where we stand in the fisheries, perhaps we can find it by comparing Soviet progress with ours in the development of two basic resources. It is said that the U.S.S.R. fondly hopes that its agriculture may catch up with ours and match it in scientific development and productivity. Many Canadians fear that in the fisheries they are already far ahead of us.

Notes and References

NOTES

[1] Stewart Bates. *The Canadian Atlantic Sea-Fishery*. p. 106.

[2] *Report of the MacLean Commission*. pp. 74-75.

[3] Kelsey and Hearne. *Cooperative Extension Work*. p. 124.

REFERENCES

[1] *Annual Report*, Department of Fisheries, Ottawa.

[2] *Trade News*
"Fisheries Fact Sheets"
"Canadian Fish Culturist"
published by the Department of Fisheries, Ottawa.

[3] *Reports* of the Fisheries Research Board of Canada.

[4] *Reports* of Fisheries Divisions of Provincial Governments.

[5] *Reports* of universities receiving federal grants for the education and organization of fishermen.

[6] *Canada Year Book* and *Canada Handbook*, published by the Dominion Bureau of Statistics, Ottawa.

Bibliography

1. Bates, Stewart. *The Canadian Atlantic Sea-Fishery*. Report of the Royal Commission on Provincial Development and Rehabilitation (Nova Scotia.) Halifax: King's Printer. 1944. pp. 179.

2. Coady, M.M. *Masters of Their Own Destiny*. New York: Harper. 1939. pp. 170.

3. Coady, Dr. M.M. *Organizing Rural People for the Proper Use and Conservation of Natural Resources*. (Paper presented to the UN Economic and Social Council, 27 July 1949; Plenary Meeting 10 (b) on Using and Conserving Resources). pp. 20 (mimeo).

4. Coady, Rev. M.M. et al. *The Antigonish Way* (Series of broadcasts over CBC). Antigonish: Extension Department, St. Francis Xavier University. 1943 (reprinted 1948 and 1954). pp. 82.

5. Colombain, Maurice. *Cooperation: A Workers' Education Manual*. Geneva: International Labour Office. 1956. pp. 157.

6. Colombain, Maurice. *Cooperatives and Fundamental Education*. Paris: Unesco. 1950. pp. 171.

7. Cornell University (New York State College of Agriculture: Rural Education Department). Comparative Extension Publications. No. 4 — *A Collection of Principles and Guides*.

8. FAO of the United Nations. *Report of the F.A.O. Training Centre in Fishery Co-operatives*. (two vols.) Rome: FAO. 1958.

9. FAO/ILO. Technical Meeting on Fishery Co-operatives (Naples, May, 1959; *Proceedings and Working Papers*, including one on "Education and Training for Fishermen's Co-operatives"). Rome: FAO. 1959. (mimeo).

10. Horace Plunkett Foundation (London). *Year Book of Agricultural Co-operation*. 1947 (pp. 68 — 76) "Co-operative Organization of Fishermen." 1956 (pp. 129-36) "Norwegian Fishermen's Co-operation."

11. Kelsey and Hearne. *Cooperative Extension Work*. Ithaca, New York: Comstock Publishing Associates, 1949. (Note: In this study the word "cooperative" does not refer to co-operatives or the cooperative movement, but to the joint action of several agencies in agricultural services in the U.S.A.).

12. Kidd, J.R. *How Adults Learn*. New York: Association Press. 1959. pp. 324.

13. Laidlaw, A.F. *A Factual Outline of the Antigonish Movement. Antigonish:* The Extension Department, St. Francis Xavier University. 1949; revised 1955.

14. Laidlaw, A.F. *Extension Work in the Co-operative Movement*. Bombay: Reserve Bank of India. 1958. pp. 51.

15. MacKenzie, W.C. "Fisheries" in *Encyclopedia Canadiana* (Vol. 4). Ottawa: The Grolier Society of Canada. 1958. pp. 146-167.

16. Newfoundland Fisheries Development Committee (Walsh Commission). St. John's: Department of Fisheries and Co-operatives; Ottawa: Department of Fisheries. 1953. pp. 122. *Report of Committee*.

17. Royal Bank of Canada. *The Rela-*

tionship of Man and Nature. (Monthly Letter, May 1960). pp. 4.

18. Royal Commission Investigating the Fisheries of the Maritime Provinces and the Magdalen Island. (MacLean Commission). *Report*. Ottawa: King's Printer. 1928. pp. 125.

19. Royal Commission on Canada's Economic Prospects (Gordon Commission). *The Commercial Fisheries of Canada*. (prepared by the Department of Fisheries and the Fisheries Research Board of Canada). Ottawa: Queen's Printer. 1957. pp. 128 and appendices.

20. Sømme, Sven. Fisheries Extension Service, *Professional Education of Fishermen in Norway*. Oslo. 1953. pp. 44 (mimeo).

21. United Nations. *Rural Progress Through Cooperatives*. New York: UN Dept. of Economic Affairs. 1954. pp. 112.

The Management of Atlantic Salmon

C. J. Kerswill,[a]
Fisheries Research Board of Canada,
Biological Station,
St. Andrews, N.B.

Investigations carried out since 1949 by a federal-provincial co-ordinating committee have indicated that catches of Atlantic salmon, in decline since 1930 but showing some improvement since 1955, can be restored at least to the average of the years between 1930 and 1959. Sport fishing might also be improved. This would mean an annual commercial catch of about 6.8 million pounds and an angling take of about 75 thousand fish in the Maritime Provinces, Quebec and Newfoundland.

Best use of the stocks of Atlantic salmon should be attained by effective manipulation of the resource and the enforcement of recommended regulations, drafted on a sound biological basis, by appropriate management and protection staffs. Economic benefits of both commercial and sport fisheries must be considered as well as the conflicts between those interests. However, the human side of the economic situation generally must also be taken into account because other activities (hydro power, forest industries) which affect salmon could outweigh fisheries if the dollar value of any resource were to be its most important factor.

Commercial salmon fishing statistics go back to 1870 for the Maritime Provinces and Quebec, and to 1910 for Newfoundland. The last year of peak production was 1930, with 13 million pounds. The 1959 catch was 61 per cent of the 1910-59 average.

The federal Government and the governments of the Atlantic provinces established the co-ordinating committee to investigate the factors limiting production and utilization of Atlantic salmon. The program followed has called for close liaison between all participating individuals and groups and for the provision of information for the general public, as well as for extensive biological and economic research. A new approach to the topics of behavior and physiology of salmon is underway.

Progress has been made in developing practical knowledge of growth and natural mortality of young salmon up to the smolt stage, and a maximum rate of smolt production for specified areas, under controlled conditions, has been estimated. Scale readings and data on the recovery of marked or tagged fish have provided clues to the survival rate of salmon in the sea. The combined commercial and sport fisheries appear to remove, on the average, about one-quarter of the total adult salmon stock.

The improvement of natural conditions in streams, the creation of artificial spawning beds and artificial freshets, and the transportation of large fish have all proved successful. Further experimentation in habitat improvement is needed. A promising development is the rearing of hatchery stock to smolt size, a method followed in Sweden, where power development has eliminated natural rearing areas. The reduction in numbers of competitive species of fish and experimental control of predator birds, particularly American mergansers, has improved the survival rate of fry.

Much research has been carried out on pollution problems but there is need for a special staff to assess the extent of industrial and domestic pollution. Extensive aerial spraying of forests with DDT since 1942 to control an outbreak of spruce budworm has polluted rivers in New Brunswick and Quebec. The losses of fry and older young salmon through spraying have been assessed, as has the reduced abundance of aquatic insects which are the main food of young salmon. Experiments have shown that a reduced concentration of DDT has had less harmful effects, and a planned modification of the DDT formula in future spraying operations is expected to reduce further damage to stock. The effects of mine effluents and deforestation are also under study, and fish passage facilities have been built or recommended to minimize loss or damage from natural or man-made obstructions.

Potential handicaps to maintaining the 1910-59 average level of production are pollution and other harmful changes in the freshwater environment, which good management could keep from being too serious. Predatory bird control and the planting of hatchery-reared stock of smolt size may also bring about improvement.

Growing concern over the steady decline in commercial catches of Atlantic salmon since 1930 led the federal Government and the Governments of the Atlantic provinces to join forces in 1949, by setting up a co-ordinating committee to investigate those factors which limit salmon production and its utilization. The objective was to assure, by improved management, the optimum *yield of salmon* to both commercial fishermen and anglers.

This paper will use Atlantic salmon as a case study in considering the multiplicity of and the interrelationships among factors that may affect a fish population and its exploitation. Anadromous species like salmon are often considered to need more complex management schemes than other fishes. Their life cycles involve important stages in both fresh and salt water. Wide variations occur in the timing and duration of different phases of the cycle in different coastal areas. Most of the fishing is done while adults are moving toward fresh-water spawning areas, and the runs must pass consecutively through fishing areas used by a variety of people, all intent on a good catch. Moreover, both netters and anglers set maximum value on particular runs, usually those returning toward the rivers early in the season. But since salmon spend considerable time in confined waters and can be counted as they move to and from the sea, they are more adaptable to management than many species that are entirely marine or fresh-water.

To simplify the discussion the writer prepared a diagrammatic scheme of Atlantic salmon management and of the research that must precede and afterwards be carried on along with management (Figure 1).

We do not imply that priority *must* be given to topics shown first at the top of the diagram. It may often be necessary to apply management schemes on a trial basis before adequate supporting evidence has come from research (1). Neither do we wish to create the impression that our research and management program has reached a stage of development as complete as the diagram indicates.

Concern – Liaison

The scheme starts with *Concern*, or general anxiety over the state of the fishery, and ends with *Liaison*, meaning communication and response among all participating individuals and groups as well as with the public. As soon as work begins, liaison must develop and gradually strengthen. It must be maintained among scientists and administrators with diverse responsibilities, fishery officers, commercial fishermen, anglers, guides, conservation associations, and many others. It has been carried on by various means, including annual meetings of a scientific advisory group responsible to a Federal-Provincial Atlantic Fisheries Committee, annual reports in the Department of Fisheries' *Trade News*, addresses at meetings, radio interviews, correspondence, visits with fishery officers and fishermen, and discussions with visitors to field operations.

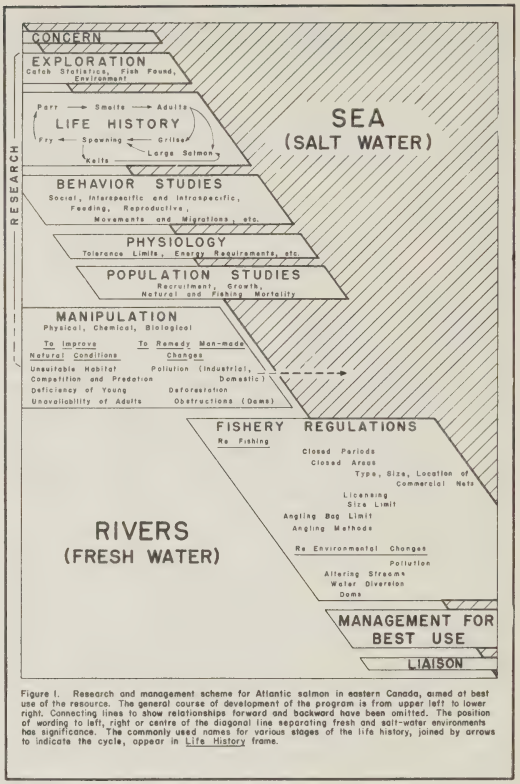


Figure 1. Research and management scheme for Atlantic salmon in eastern Canada, aimed at best use of the resource. The general course of development of the program is from upper left to lower right. Connecting lines to show relationships forward and backward have been omitted. The position of wording to left, right or centre of the diagonal line separating fresh and salt-water environments has significance. The commonly used names for various stages of the life history, joined by arrows to indicate the cycle, appear in Life History frame.

The research program, comprising the next five frames of the scheme and extending into *Manipulation*, has included investigations by the Biological Research Board of Canada (Biological Board of Canada before 1938) at St. Andrews, New Brunswick, and St. John's, Newfoundland, and the Province of Quebec's Marine Biological Station at Grand River. Assistance has been provided by protection and management staff of the Conservation and Development Service of the federal Department of Fisheries, by the Canadian Wildlife Service and by the Nova Scotia Research Foundation. Work is also done in co-operation with the New Brunswick Department of Lands and Mines and the Forest Biology Division of the Department of Agriculture (now the Department of Forestry).

Altantic salmon management is the responsibility mainly of the federal Department of Fisheries' Conservation and Development Service in the Maritime Provinces and Newfoundland, and the Protection and Management Service of the Provincial Department of Fisheries in Quebec.

Exploration – Life History

Statistics on commercial salmon landings in the Maritime Provinces and Quebec go back to 1870 and are available since 1910 for Newfoundland, with acceptable accuracy. Since 1949 both commercial and angling statistics are available for the Maritime Provinces under a revised system. During the 1910-1959 period total commercial landings in Newfoundland, the Maritime Provinces and Quebec averaged 6.8 million pounds a year. The last year of peak production was 1930 when landings totaled over 13 million pounds. Since 1949 catches have been below average but some improvement occurred since 1955, and the 1959 catch was 61 per cent of the long-term average (2). Similarly low catches occurred in Great Britain before and after peak production around 1930, suggesting that availability of salmon on both sides of the Atlantic is affected by common environmental conditions (3). Examples of total landed values of the commercial catch are $1.3 million in 1953 and $1.2 million in 1954 (4). In recent years total angling catches have averaged about 75,000 fish a year. The Miramichi River, N.B., alone gives about 30,000 fish; the second highest angling catch is on the Restigouche River, N.B., averaging about 3,000 a year; and all Newfoundland rivers give about 20,000 (5). Quebec rivers provide about 12,000 salmon a year to anglers, with an estimated value of $158 per fish (6).

Exploratory work from 1930 to 1940, by Huntsman, Belding and Préfontaine yielded much valuable *life history* information. They described the age composition of salmon caught in several coastal fishing areas of the Maritime provinces and off Port aux Basques, Newfoundland, as shown by scale reading (7, 8, 9, 10). A relationship between the length of salmon and their scale measurements was indicated (11). Other background publications include those by White on age determination of parr (12), food of parr (13) and parasitic copepods (14, 15). Battle described, in detail, the embryology of the Atlantic salmon (16). New information on food of young salmon is coming from recent studies concerned with DDT spraying in New Brunswick (5).

Thorough research on several topics is still needed to provide adequate background for comprehensive management. For example, well-designed experiments on genetics should be undertaken to clarify such important points as the role of heredity in determining the time of entry of adults into fresh water, and why some fish mature as grilse after only one year at sea. New experimental hatchery facilities are a prerequisite for such studies.

Behavior Studies – Physiology

These topics have been closely associated in fisheries investigations but there is a growing tendency to segregate them. Topics like factors affecting smolt descent (17) and homing (18) may be classified under *Behavior Studies*. Large-scale smolt marking experiments since 1950 on several rivers have shown that many salmon produced in Maritime rivers may travel long distances in the sea and be caught far away in commercial fisheries, but homing to the river of origin is highly developed (3). By smolt marking and adult tagging the return trip of one salmon from the Margaree River, Nova Scotia, to Newfoundland was recorded (22). The response of young salmon and trout in a temperature gradient (19) would come under *Physiology*. Other examples of physiological work on tolerance limits are papers on tolerance to sea water (20) and salmon deaths with high temperatures (21). A new approach to the topics of behavior and physiology, using the most modern available methods of experimentation and data analysis, is underway. Plans have been made for comprehensive behavior studies at the Biological Station, St. Andrews, N.B. (23), and the work started in 1958. It is hoped that physiological experimentation, using suitably acclimated specimens, can be undertaken soon.

Population Studies

Good progress has been made by Elson (24) in developing practical knowledge of the growth and natural mortality of young salmon in streams up to the time of migration as smolts. It appears that the maximum rate of smolt production that can be expected from a typical Maritime salmon river is five to six smolts per 100 square yards, if predatory birds are controlled. Working backward through the earlier life history stages, for maximum smolt production there should be about 10 parr per 100 square yards if the river commonly produces smolts in two years, and 20 parr per 100 square yards if the river produces smolts in three years. There should be about 12 to 20 fry produced per 100 square yards each year. This requires the annual spawning of about 44 pounds of female salmon per mile of stream 10 yards wide, calculated on the basis of female salmon carrying 800 eggs per pound of weight. Useful clues to the survival rate of salmon in the sea, i.e. from the smolt stage to adults, when they may be caught as grilse or older salmon, have come from preliminary analysis of scale readings and from data on recovery of fish marked or tagged as smolts. On the average it appears that about eight per cent of smolts survive the rigors of

life in the sea and return to fisheries and rivers as mature salmon (25). Fishing mortality in the Maritime provinces has been estimated from the data of several experiments involving recaptures by various fisheries of salmon that had been tagged and released. The estimate is about 27 per cent, that is, the combined commercial and sport fisheries appear to remove, on the average, about one-quarter of the total adult salmon stock (24). In some areas, estimated fishing mortality exceeds 50 per cent and estimates are usually low through incomplete tag recovery. The effect of lateness of some salmon runs on catchability is discussed later. Mathematical models, useful in developing the population dynamics of commercially exploited sea fishes like cod and haddock, have not yet been explored as tools for Atlantic salmon studies.

Manipulation

The term *manipulation* is used here in a more limited sense than *management*. *Manipulation* is considered to include activities resulting from investigations of the fish and environment together such as, (a) the improvement of natural conditions for young salmon in streams, and (b) the modification of man-made situtations that may be harmful to the fish. *Management* includes environmental manipulation and also regulation of the fishery. For practical reasons manipulation is now limited to fresh water, but it is conceivable that procedures like predator control might be extended to the sea in the future.

i. *Unsuitable Habitat*

There has been little attempt in eastern Canada to improve living conditions, for salmon, by physical stream improvement. It would involve addition of stones on open bottom to increase the number of hiding places for parr, alteration of flow patterns, increasing shade, and so on. Planning will likely be aided by the results of present investigations of behavior patterns of young salmon in various situations. An outstanding contribution was made by White (26) through his study of the structure of salmon redds in spawning beds on Moser River, N.S. Artificial spawning beds which he prepared were promptly used by salmon in an area where beds were poor and too few. Experiments with artificial freshets to attract salmon into rivers from the sea and improve angling have been conducted by Huntsman (27) and Hayes (28). The results showed promise of usefully moving fish when other conditions were favorable, but physical and economic difficulties stand in the way of practical development.

There is a need for more experimentation with habitat improvement.

ii. *Deficiency of Young Fish*

The problem of using hatchery-reared Atlantic salmon to best advantage has been investigated since 1942 by the Fisheries Research Board of Canada, mainly on the Pollett River, N.B. The investigation was facilitated by development of the technique of assessing young fish populations by electroseining (29, 30). Smolt production studies, with and without predatory bird control, have established numerical and seasonal requirements for stocking unit areas with fish of different sizes. The desirable amount of dispersal of stocked smolt has been defined (31). For example, on a geologically fertile stream averaging 10 yards in width, if merganser abundance does not exceed one bird for every 10 miles, the maximum production of smolts is likely to be around 1,000 per mile. To get this number, about 7,000 underyearlings should be planted per mile in streams with mostly two-year-old smolts; about 10,000 per mile are needed in streams with mostly three-year-old smolts. If streams have no bird control or are in geologically infertile areas, maximum expectancy is 400 smolts per mile, and plantings should be be lowered to 2,500 and 3,500 fish per mile to avoid waste of hatchery stock.

Rearing hatchery stock to smolt size before planting, as in Sweden's power-developed rivers where stream-rearing areas are practically nonexistent (32, 33), is a promising development needing careful experimentation here. The size requirement of young salmon to make smolts has been found to be generally a length of four inches (10 cm) reached in the growing season preceding the spring of smolt transformation (34). In the past two years, small-scale experimental plantings of marked and tagged hatchery-reared smolt-sized fish have been made in Quebec and several New Brunswick rivers. Smolt planting, through eliminating the need for extensive stream-rearing areas, might be a practical way to increase Atlantic salmon production significantly if economical rearing techniques can be developed.

iii. *Competition and Predation*

Little effort has yet been directed to special studies of salmon competition with other fishes, but useful findings have emerged from other research projects. For example, recent studies of the effects of aerial DDT spraying in the Miramichi watershed showed unusually good survival of the abundant 1955 fry in the year after spraying first occurred, presumably because other competitive species had been reduced in numbers (5). Competition and predation involving other fish species had to be considered in experimental control of mergansers, but no serious side effects were found. Eels are known

to consume many salmon fry at times (35) and their control needs consideration.

The harmful effect of predatory birds on young salmon production was reviewed first by White (36) and has been investigated extensively since. The life history and feeding habits of the eastern belted kingfisher and the economic status of control were investigated thoroughly (37). Similar studies on mergansers were made by White (38) and Elson (30). These studies show that kingfisher control to improve salmon production is desirable only in some instances, usually near fish-rearing establishments. Merganser control, however, appears necessary to make full use of stream-rearing areas and assure maximum smolt production (31). Unusually heavy smolt production by a river might have unknown side effects, such as increasing the number of sea predators. Hence the effects of merganser control on adult salmon production are being investigated before considering it to be an established management procedure.

iv. *Unavailability of Adults*

Adult salmon may be plentiful in rivers but unavailable to anglers during popular sport-fishing periods, so that a valuable part of the potential crop is wasted. When reliable information is obtained on spawning requirements for more rivers, it will be desirable to investigate the possibilities for increasing availability of fish to anglers. Conditions might be created to retain fish at sites where they would be more readily accessible. Care would have to be exercised to avoid favoring some anglers more than others.

v. *Pollution*

Research staff to investigate pollution problems associated with Atlantic salmon and other species now comprise one scientist and a technician, recently appointed at the St. Andrews Station. Elsewhere there is no full-time investigational staff. There is a recognized need for special staff to assess the extent of industrial and domestic pollution leading to adequate control measures.

Serious pollution of salmon rivers in Quebec and New Brunswick has resulted from extensive aerial spraying of the forests since 1942, to control an outbreak of the spruce budworm. Long-term studies of salmon production in the Miramichi, started in 1950, provided background information for quantitative assessment of the effects of DDT on native salmon populations. Drastic reductions in fry of the year and sizeable but less severe losses of older young salmon have been shown by annual autumn electroseining assessment to occur regularly after spraying (39, 40, 41, 42, 43, 5). Aquatic invertebrates that are the main food of young salmon were reduced also (44). Lower adult salmon stocks several years later were forecast (45), and are occurring much as predicted (5). Experiments in 1958 and 1959, in co-operation with the Forest Biology Division, Canada Department of Agriculture, indicated that a reduced DDT concentration had less harmful effects on both young salmon and aquatic invertebrates (5). As a result, half-strength DDT insecticide was used on part of the two million acres sprayed in central New Brunswick in 1960, with encouraging results. Modification of the DDT spray formula seems to offer the only hope of reducing damage to salmon stocks.

The possibility of newly developed mines having severe effects on salmon, unless effluents are properly handled, became apparent in 1960 when a new but recently unused copper and zinc mine in the Northwest Miramichi watershed was pumped out. Adult salmon would not ascend to upper reaches of the river for several weeks. Young salmon and aquatic invertebrates became scarce for several miles below the mouth of the affected tributary. Action has been taken to rectify the situation.

vi. *Deforestation*

Extensive pulpwood cutting along tributary salmon streams is causing major environmental changes in many areas (43). Plans are being made for long-term investigation of the effects on salmon production, including effects of run-off silting and rising water temperatures. Field investigations have been impossible so far because of staff limitations.

vii. *Obstructions*

The multiple problems, relating to anadromous fish, caused by dams, e.g., the Tobique Narrows and Beechwood power dams on the St. John River, N.B., have received some attention (5). Much effort has been spent in connection with fish passage facilities at these and many other dams by the management staff of the Canada Department of Fisheries (46). From limited available information on local abundance, life histories and behavior of anadromous species, it was necessary to estimate the effects of the proposed Passamaquoddy power project on anadromous fish (47). Unless adequate fishway facilities were provided (48), it was expected that potential production of most anadromous species, including salmon, would be reduced.

Fishery Regulations

The primary aim of regulations (49) is to assure adequate spawning escapement and still make maximum use of the resources. Because of inadequate knowledge of salmon, many of the existing regulations are likely too restrictive.

To indicate the scope of regulations needed for the Atlantic salmon fisheries, a section of Figure 1 shows the main headings used for a classification

scheme developed in 1958 by a Regulations Sub-committee of the Federal-Provincial Atlantic Fisheries Committee. Available knowledge of salmon and the commercial and sport fisheries was used to redraft existing complex regulations. In the new draft, except for a few regulations of administrative, economic and sociological significance, all restrictions on fishing have a sound biological basis. It is hoped that the new simplified and somewhat liberalized regulations will be enacted soon, after comments and suggestions from all interested groups have been considered.

Before deciding what to include in the recommendations on new regulations, the Sub-committee reached agreement on certain principles, including the following: (a) the decreased availability of Atlantic salmon as shown by commercial catch statistics, coupled with the vulnerability of salmon during their fresh-water life, are major reasons for retaining certain regulatory controls on fishing, (b) the present level of utilization of the resource seems to be close to a maximum for current stock levels, although it is recognized that in some instances the stocks of specific rivers are underexploited and others overexploited, (c) industrial development, particularly in the southern part of the salmon's range, is a limiting factor controlling the size of stocks, (d) certain general regulatory controls are needed to protect stocks because scientific knowledge is insufficient to establish the optimum escapement and optimum harvest level for stocks of all specific areas, (e) since many restrictions in the existing regulations have insignificant value and a general policy of liberalization is desirable, complete closures should be placed on specific fishing areas if signs of serious decline appear in the associated rivers, (f) at the present level of knowledge of escapement requirements and salmon behavior, management can be carried on more efficiently if utilization is confined to estuaries and rivers, where the respective runs have become segregated, (g) Atlantic salmon stocks appear adequate to support both a commercial and a sport fishery, (h) regulations should allow the present policy of a public right of fishing to be followed, but it is recognized that leasing of fishing waters and local control of fishing may sometimes assist the management of particular salmon runs, and (i) since provincial laws often regulate land and water use, close liaison is needed between the Canada Department of Fisheries and the provincial governments concerned regarding the control of fresh-water habitats, to prevent undue development of one resource without full consideration of others.

Management for Best Use

It should be possible to attain this goal by effective manipulation and enforcement of regulations, to be carried out by appropriate management and protection staffs. Extensive salmon management activities of the Canada Department of Fisheries' Fish Culture Development Branch in the Maritime Provinces and Newfoundland include hatchery operation, experimental predatory bird control, and attention to problems associated with hydro-electric developments, pollution, inadequate adult escapements through obstructions and other factors. In Quebec the Provincial Protection and Management Service is engaged in an extensive program of salmon stream improvement (46, 50).

As implied in the section on fishery regulations, the conflict between different interests in the use of Atlantic salmon must be taken into account. The economic significance of the problem was outlined by Grasberg (51) in his survey of the economic benefits of salmon to New Brunswick and by Maheux (6) for Quebec. Their surveys suggest that the sport fishery produces more wealth per pound of fish than the commercial fishery. But Grasberg cautions that dollar figures do not show everything and must be used with discretion since every economic situation has its human side. If this were not so, any attempt to save salmon, no matter for whose benefit, should be given up because electric power dams, the spraying of woodland with DDT, and similar activities affecting salmon runs can create more dollar value than all uses of salmon taken together.

Anglers often feel that many more fish would be available to them if commercial fishing were curtailed. Generalized conclusions cannot be drawn on this point and the impact of commercial net fisheries on local angling must be assessed for each river system. Many commercial fishing operations for Atlantic salmon, seem to be rather inefficient, as compared, for example, with commercial fishing for Pacific species. Frequently the nets cannot be operated properly for lengthy periods because of unfavorable weather and water conditions. In some cases, as commonly occurs in the Miramichi area of New Brunswick, a large fraction of the total annual run approaches and enters the estuary and river after the close of the commercial season (40, 41). At present there is no market demand for these late-run fish, which are considered to have inferior quality. Tagging experiments in the controversial net fishery off the Margaree River, N.S., by Huntsman in 1935-37 (8) and again by Hayes in 1948 (52) showed that absence of the net fishery could have caused only a five to six per cent increase in fish available to Margaree anglers.

Complication arises also from the allocation of jurisdiction between the federal and provincial governments, as summarized by Grasberg (51). The British North America Act of 1867 placed coastal

and inland fisheries under federal jurisdiction but the provinces have property rights in non-tidal fisheries and have been delegated administrative responsibilities in varying degrees. In New Brunswick, for example, the federal authorities administer the entire commercial salmon fishery and also issue general regulations on angling. The provincial government complements the angling regulations with additional restrictions, mainly on the number of fish allowed per angler-day on various stretches of rivers. Leasing of Crown salmon waters and licensing of anglers are under provincial jurisdiction with one exception – spring angling for kelts requires special permission of federal fishery officers. There is little salmon angling on federally administered tidal waters.

The governmental effort that can be put into research and management of Atlantic salmon probably depends largely on the economic and sociological value of the combined commercial and sport fisheries in relation to the values of other fish species. It seems to be highly desirable that a thorough economic survey of salmon fisheries in all the Atlantic Provinces be made soon.

Although most of the significant early observations on life history, behavior, etc., are available in manuscript form, there is a need to consolidate known data in published form.

Prospects for Future Fishing

As mentioned above, total commercial landings in Eastern Canada fluctuated widely around an average of 6.8 million pounds a year, from 1910 to 1959 (2), and recently totaled about four million pounds. Potential handicaps to maintaining this level of production are pollution and other harmful changes in the fresh-water environment, associated with industrial developments. If these handicaps do not become too serious, commercial catches should return to at least the past average level. Still further improvement seems possible through management procedures like predatory bird control and the planting of hatchery-reared stock of smolt size.

This optimistic view is strengthened by the recent return to normal of average annual water temperatures off our coast, after being two to three degrees Fahrenheit above normal during the 1949-1954 period. There has been an inverse relationship between average annual sea temperature and commercial salmon catches since 1921, the first year when relevant temperature records were kept. Years with highest temperatures had lowest salmon catches (40). Although this may be only a coincidence, with no biological significance, it is possible that increased water temperature might cause salmon in the sea to avoid netting areas or even reduce smolt survival. Sea temperatures are predicted to continue a net downward trend over the next 20 years (54).

Angling catches may continue to average about 75,000 fish a year for the whole Atlantic area, but some increase might occur as new rivers become accessible in remote areas.

Notes and References

[a] My colleagues, especially J.L. Hart, M.W. Smith and P.F. Elson, of the Fisheries Research Board's Biological Station, St. Andrews, New Brunswick have made helpful suggestions in the preparation of this paper.

[1] Pritchard, A.L., and W.M. Sprules. "Administration and research", *Canadian Fish Culturist*, No. 12. 1952. pp. 4-9.

[2] Kerswill, C.J. "Commercial landings of Atlantic salmon in Canada, 1910-1959". *Atlantic Salmon Journal for 1960*, No. 3. 1960. pp. 5-6.

[3] Kerswill, C.J. "Recent developments in Atlantic salmon research". *Atlantic Salmon Journal*, No. 1. 1955. pp. 26-30.

[4] Elson, P.F., and C.J. Kerswill. "Studies on Canadian Atlantic salmon". *Transactions of the 20th North American Wildlife Conference* 1955. pp. 415-426.

[5] Kerswill, C.J. "Investigation and management of Atlantic salmon in 1959-60. Part 1. The Research Programme". *Trade News*, Canada Department of Fisheries, 12(12). pp. 3-11.

[6] Maheux, G. "Atlantic salmon in the economy of the Province of Quebec" in *Les Presses Universitaires Laval*, Quebec, 1956. pp. 30.

[7] Huntsman, A.G. The Maritime salmon of Canada. *Bull. Bio. Bd. Canada*, No. 21. 1931. pp. 99.

[8] Huntsman, A.G. "Salmon for angling in the Margaree River" in *Bulletin of the Fisheries Research Board*, Canada, No. 57. 1939. pp. 75.

[9] Belding, David L., and Georges Prefontaine. "Studies on the Atlantic salmon – II. Report on the salmon of the 1937 Port-aux-Basques (Newfoundland) drift-net fishery". *Contributions of the Institute of Zoology*, University of Montreal, No. 3. 1938. pp. 1-58.

[10] Belding, David L., and Georges Prefontaine. "Studies on the Atlantic salmon – III. Report on the salmon of the 1937 Miramichi (New Brunswick) drift-net fishery". *Contributions of the Institute of Zoology*, University of Montreal, No. 4. 1939. pp. 1-63.

[11] Kerr, R.B. "Scale to length ratio, age and growth of Atlantic salmon in Miramichi fisheries" in *Journal of Fisheries Research Board*, Canada, 18(1). 1961 pp. 117-124

[12] White, H.C. "Age determinations of salmon parr by effect of rate of growth on body proportion". Journal of Biological Board, Canada, 1936. 2(4). pp. 379-382.

[13] White, H.C. "The food of salmon fry in Eastern Canada." Journal of Biological Board, Canada. 1936. 2(5). pp. 499-506.

[14] White, H.C. "Sea Lice *(Lepeophtheirus)* and death of salmon." *Journal of Fisheries Research Board*, Canada, 1940. 5(2). pp. 172-175.

[15] White, H.C. "Life history of *Lepeophtheirus salmonis*." *Journal of Fisheries Research Board*, Canada. 1942. 6(1). pp. 24-29.

[16] Battle, H.I. "The embryology of the Atlantic Salmon *(Salmo salar* Linnaeus.)" Canadian Journal of Research *D*. 1944. 22. pp. 105-125.

[17] White, H.C. "Factors influencing descent of Atlantic salmon smolts." *Journal of Fisheries Research Board*, Canada. 1949. 4(5). pp. 323-326.

[18] White, H.C. 1936. "The homing of salmon in Apple River, N.S." *Journal of Biological Board*, Canada. 1936. 2(4). pp. 391-400.

[19] Fisher, Kenneth C., and Paul F Elson. "The selected temperature of Atlantic salmon and speckled trout and the effect of temperature on the response to an electrical stimulus." *Physiological Zoology*. 1950. 23(1). pp. 27-34.

[20] Huntsman, A.G., and W.S. Hoar. "Resistance of Atlantic salmon to sea water." *Journal of Fisheries Research Board*, Canada, 1939. 4(5). pp. 409-411.

[21] Huntsman, A.G. "Heat stroke in Canadian Maritime stream fisheries." *Journal of Fisheries Research Board*, Canada. 1946. 6(7). pp. 476-482.

[22] Blair, A.A. "Atlantic salmon tagged in east coast Newfoundland waters at Bonavista". *Journal of Fisheries Research Board*, Canada. 1956. 13(2). pp. 219-232.

[23] Keenleyside, M.H.A. "Research on the behaviour of Atlantic salmon at the Biological Station, St. Andrews, N.B." in *Symposium on Fish Behaviour*, Food and Agriculture Organization of the United Nations, Indo-Pacific Fisheries Council, Proceedings of the 8th Session (1958), Section three (in press).

[24] Elson, P.F. "Number of salmon needed to maintain stocks." *Canadian Fish Culturist*, No. 21. 1957. pp. 19-23.

[25] Elson, P.F. "The role of hatcheries in assuring Maritime stocks of Atlantic salmon." *Canadian Fish Culturist*, No. 21. 1957. pp. 25-32.

[26] White, H.C. "Atlantic salmon redds and artificial spawning beds." *Journal of Fisheries Research Board*, Canada. 1942. 6(1). pp. 37-44.

[27] Huntsman, A.G. "Freshets and fish." *Transactions of the American Fishery Society*, 1948. No. 75 pp. 257-266.

[28] Hayes, F.R. "Artificial freshets and other factors controlling the ascent and population of Atlantic salmon in the LaHave River, Nova Scotia" in *Bulletin of the Fisheries Research Board*, Canada, 1953. No. 99. pp. 47.

[29] Elson, P.F. "Usefulness of electrofishing methods." *Canadian Fish Culturist*. 1950. No. 9. pp. 3-12.

[30] Elson, P.F. "Predatory-prey relationships between fish-eating birds and Atlantic salmon" in *Bulletin of Fisheries Research Board*, Canada (in press).

[31] Elson, P.F. "Using hatchery-reared Atlantic salmon to best advantage." *Canadian Fish Culturist*. 1957. No. 21. pp. 7-17.

[32] Carlin, B. "Results of salmon smolt tagging in the Baltic area". *Rapports et procès-verbaux des réunions du Conseil Permanent International pour l'Exploration de la Mer*. Charlotten-lund-Slot, Denmark. 1959. No. 147. pp. 89-96.

[33] Carlin, B. "Salmon conservation in the Baltic". *Rapports et procès-verbaux des réunions du Conseil permanent International pour l'Exploration de la Mer*. 1959. No. 148. pp. 60-62.

[34] Elson, P.F. "The importance of size in the change from parr to smolt in Atlantic salmon." *Canadian Fish Culturist*. 1957. No. 21. pp. 1-6.

[35] White, H.C. "Salmon fry in still water." *Atlantic Biological Board of Canada, Progress Report*. 1953. No. 7. pp. 6-8.

[36] White, H.C. "Bird control to increase the Margaree River salmon" in *Bulletin of Fisheries Research Board*, Canada. 1939. No. 58. pp. 30.

[37] White, H.C. "The Eastern Belted Kingfisher in the Maritime Provinces" in *Bulletin of Fisheries Research Board*, Canada. 1953. No. 97. pp. 44.

[38] White, H.C. "Food and natural history of mergansers on salmon waters in the Maritime Provinces of Canada" in *Bulletin of Fisheries Research Board*, Canada. 1957. No. 116. pp. 63.

[39] Kerswill, C.J., and P.F. Elson. "Preliminary observations on effects of 1954 DDT spraying on Miramichi salmon stocks." *Atlantic Progress Report*, Fisheries Research Board, Canada. 1955. No. 62. pp. 17-24.

[40] Kerswill, C.J. 1956. "Investigation and management of Atlantic salmon in 1955. Part 1. The Research Programme." *Trade News*, Canada Department of Fisheries. 1956. 8(10). pp. 5-12.

[41] Kerswill, C.J. "1956 Investigation and management of the Atlantic salmon. Part. 1. The Research Programme." *Trade News*, Canada Department of Fisheries. 1957. 9(12). pp. 5-15.

[42] Kerswill, C.J., P.F. Elson and M.H.A. Keenleyside. "Investigation and management of Atlantic salmon in 1957. Part 1. The Research Programme", *Trade News*, Canada Department of Fisheries. 1958. 10(12). pp. 4-18.

[43] Kerswill, C.J. "Investigation and management of Atlantic salmon in 1958. Part 1. The Research Programme." *Trade News*, Canada Department of Fisheries. 1959. 11(11). pp. 3-10.

[44] Ide, F.P. "Effect of forest spraying with DDT on aquatic insects of salmon streams." *Transactions of the American Fishery Society*. 1957. 86(1956). pp. 208-219.

[45] Kerswill, C.J. "Effects of DDT spraying in New Brunswick on future runs of adult salmon." *The Atlantic Advocate*. 1958. 48(8). pp. 65-68.

[46] Burridge, E.W. "Investigation and management Atlantic Salmon in 1958. Part 2. The Management Programme." *Trade News*, Canada Department of Fisheries. 1959. 11(11). pp. 11-16.

[47] Kerswill, C.J. "Effects of proposed Passamaquoddy power project on anadromous fishes in Canadian waters." *Journal of Fisheries Research Board*, Canada. 1960. 17(5). pp. 713-720.

[48] Bell, M.C., and C.H. Clay. "Facilities for anadromous fish passage, Passamaquoddy project". *Journal of Fisheries Research Board*, Canada. 1960. 17(4). pp. 507-516.

[49] Kerswill, C.J. "Regulation of the Atlantic salmon fisheries." *Canadian Fish Culturist*. 1958. No. 22. pp. 7-12.

[50] Anonymous. "Investigation and management of Atlantic salmon in 1959-60. Part 2. The Management Programme." *Trade News*, Canada Department of Fisheries. 1960. 12(12). pp. 12-16.

[51] Grasberg, E. *Economic benefits of the Atlantic salmon to the Province of New Brunswick*, Fredericton, New Brunswick. 1956. pp. 14.

[52] Hayes, F.R. "Report of the Consultant on inland fisheries – 1948. Appendix 1." *Annual report for 1948 of the Province of Nova Scotia*, Department of Trade and Industry, Nova Scotia, 1948. pp. 107-152.

[53] Lauzier, L. "Surface sea water temperatures along the Canadian Atlantic coast, 1954-1957". *Atlantic Progress Report*, Fisheries Research Board, Canada. 1958. No. 71. pp. 8-12.

[54] McLellan, H.J., and L. Lauzier. "The prediction of water temperatures". *Canadian Fisherman*, 43(9). 1956. pp. 11-12.

SCIENTIFIC NAMES OF SPECIES

SCIENTIFIC NAMES OF SPECIES
MENTIONED IN PAPERS ON FISHERIES

Alewife	*Pomolobus pseudoharengus*
Ciscoes	*Leucichthys spp.*
Clam, bar	*Spisula solidissima*
Clam, butter	*Saxidomus giganteus*
Clam, little-neck	*Protothaca staminea*
Clam, razor	*Siliqua costata*
Clam, soft shell	*Mya arenaria*
Cod, Atlantic	*Gadus morhua*
Cod, Pacific	*Gadus macrocephalus*
Crab, Pacific edible	*Cancer magister*
Flounder, yellowtail (mud dab)	*Limanda ferruginea*
Flounder, winter	*Pseudopleuronectes americanus*
Greysole (witch)	*Glyptocephalus cynoglossus*
Haddock	*Melanogrammus aglefinus*
Halibut, Atlantic	*Hippoglossus hippoglossus*
Halibut, Pacific	*Hippoglossus stanolepis*
Herring, Atlantic	*Clupea harengus*
Herring, Pacific	*Clupea pallasii*
Lamprey, sea	*Petromyzon marinus*
Lobster, American	*Homarus americanus*
Mackerel	*Scomber scombrus*
Oyster, eastern	*Crassostrea virginica*
Oyster, Pacific (Japanese)	*Crassostrea gigas*
Perch, yellow	*Perca flavescens*
Pickerel, yellow (walleye, yellow pike-perch, doré)	*Stizostedion vitreum*
Pike	*Esox lucius*
Plaice, American	*Hippoglossoides platessoides*
Quahaug	*Venus mercenaira*
Quahaug, ocean	*Arctica islandica*
Redfish	*Sebastes marinus and S. mentella*
Salmon, chinook (king, spring, tyee,)	*Oncorhynchus tshawytscha*
Salmon, chum	*Oncorhynchus keta*
Salmon, coho (silver)	*Oncorhynchus kisutch*
Salmon, pink	*Oncorhynchus gorbuscha*
Salmon, sockeye (red)	*Oncorhynchus nerka*
Scallop	*Plactopecten magellanicus*
Smelt	*Osmerus mordax*
Sole, petrale (brill, round-nose flounder)	*Eopsetta jordani*
Swordfish	*Xiphias gladius*
Tuna, bluefin	*Thunnus thynnus*
Trout, lake	*Salvelinus namaycush*
Trout, speckled	*Salvelinus fontinalis*
Whitefish	*Coregonus clupeaformis*

93452—55

Section Seven: Wildlife

93452—55½

Wildlife in Perspective

C.H.D. Clarke
Assistant Chief, Fisheries and Wildlife Branch, Ontario Department of Lands and Forests

Canada's wildlife resources were, and in large areas still are, the sustenance of our aborigines. The fur trade also determined the course of early exploration and settlement of our country. The existence of game laws as well as natural history societies in the early 19th century shows that hunting was of interest to early settlers. Continued interest and bitter experience led to the belief that the extermination of any species must be prevented.

Of our vegetational regions, only our cultivable lands have completely changed and, even so, they and the managed forest have provided a better environment for some species, as evidenced by increased populations and the extended range of some species.

Man's destruction of, or interference with, wildlife habitat is more dangerous than his hunting. Indeed, our wildlife surplus is seldom fully utilized.

The various species of blackbirds are our biggest hazard economically and although ducks do some damage to crops they are protected all over the continent to provide sport. Wildlife bolsters the economy as well. It is estimated that Canadian hunters spend about $105 million on their sport annually. The total value of wildlife to tourism cannot be exactly determined, but non-resident anglers in Ontario spend $2¼ million for licences alone.

Although the value of wildlife in tourism is certainly great, our people must receive first consideration in any conflict of interest over wildlife.

Hunting pressure increases at a greater rate than population growth; rather, it seems to follow the increase in real wealth. At the end of this century, four-fifths of our population will live in cities. With more leisure time there will be a great demand for day-use outdoor recreation. It is expected that, under proper management, farmed and unfarmed land around metropolitan areas can be used for hunting, but there is the possibility that wildlife lands will be sacrificed for immediate economic gain. The attractiveness of holiday lands – requiring more than a day to reach – to our people and tourists will depend on how well natural beauties are maintained.

Recognition that factors other than hunting affect wildlife populations is nowadays reflected in a loosening of restrictions and rescinding of preserves. The new science of animal numbers has taught us that an area can only support a certain numbers of animals and that if the surplus is not harvested it is wasted.

The question is, can we reconcile our vision of nobility, beauty, and permanent values with our desire for prosperity and progress? The therapeutic value of nature is undoubted, yet we cut down on funds to preserve it in order to provide institutional beds, the need for which would lessen if there were more contact with nature. Although we have a conscience about wildlife, it is underestimated because it is, for the most part, a private conscience rather than a public conscience – the basis for wildlife conservation.

Wildlife is recognized today as an important renewable natural resource, *used* by our people in a bewildering variety of ways. Our national character has been established and can only be maintained intact in a healthy, spacious landscape with a rich and varied wildlife. Our wildlife resources were, and in large areas still are, the sustenance of our aborigines. The fur trade determined the course of the early exploration and settlement of our country. Game species, and the throng of wild creatures of all sorts, brightened the harsh life of the pioneers. Today the hand of nature can keep us from losing our way in the artificial maze of modern life. Wildlife can be a sensitive indicator of the quality of our environment. Like the coal miner's

canary, it can warn us of deterioration before we become conditioned, by the loss of all our finer instincts, to accept what we should have opposed and rejected in the first place.

The first census of Canada shows us cloth and flannel being made at home in quantity enough to clothe and bed much of our country population. It goes well with what we know of corduroy roads, log cabins and pigeon pie. However, only the clarity of hindsight permits us to see the Canada of today in the mirror of the past. The Canadian is a little more recognizable and one of his earliest developed characteristics was a great enthusiasm for, and concern about, wildlife. Even to the pioneer, the spoils of hunting and angling were more important as morale builders than as food supplements. A man had no time for hunting trips while farming operations were in progress, but when the season brought a lull he had his chance and seized it.[15] When the course of work took him to the woods he would be sure to take his gun,[9] and no man could resist a flight of wild pigeons. There is ample evidence that the ease with which field sports could be indulged in was a lure to immigrants and a compensation for hard work.[8,1]

A society that frowned on frivolity and rejected many popular forms of amusement still conceded dignity and prestige to the hunter, so long as his pursuits did not seriously interfere with his work. Garrison officers set the pace in perpetuating old world traditions of field sports for those who had leisure.[12,13] The settler loved the flowers and wild creatures that flourished around his clearings. Canada had some of the earlier natural history societies in North America, in the Quebec Literary and Historical Society (1824 or earlier), and the Montreal Natural History Society (1827 or earlier). We had also a very early natural history museum (Chas. Fothergill's, 1817); artists who painted birds almost as early and as well as Wilson and Audubon (Fothergill, 1817, and Wm. Pope, 1835); a special bird protection law (1864); and the first bird sanctuary on the continent at Last Mountain Lake on the prairies of the northwest, in 1887.[14] There was an organized sportsmen's group in Toronto in 1860,[2] and we had game laws in our original provinces when all but a few thousand acres of our land were still the patrimony of the Indians. Confederation came to a land in which the basic element of wildlife conservation — popular interest publicly expressed — was already familiar. Can as much be said of any other aspect of conservation?

Surely, two dramatic events have influenced the thinking of our people on wildlife more than anything else. When our provinces became one nation and for a few years thereafter, there were millions of passenger pigeons across the land, and great herds of buffalo covered the prairies. Before our people had properly gotten used to Dominion Day as a holiday, both species had vanished. True, a few flocks and herds still lingered in hidden places, but both species were dramatically gone, and everybody missed them. There was a clear memory of great slaughters, and a strong conviction that transcended all realization that the land had changed and was scarcely the place for passenger pigeons or buffalo that it once was. We could not save the pigeons, even when there were still a few and we knew they were vanishing. We were, however, able to do something about the buffalo. These facts have helped us mold our national attitudes towards wildlife. Conservation for us starts with the conviction that the extermination of any species can and must be prevented.

What was known about wildlife? In retrospect we can see that whereas there were lists of species and many interesting commentaries on their importance, when it came to management much that seemed to be known was not knowledge. Local shortages of game were invariably attributed to hunting or predators. In some cases this may have been fair enough, but there were other factors at work. We recognize in the local shortages of grouse and snowshoe hares the familiar fluctuations in abundance that still mystify us. That a shortage of hares was not necessarily caused by hunting or predators was, however, suggested by many.[12,21] There was much more than hunting or predators, also, behind the rise and subsequent failure of the bob-white quail when the rich southern lands of Ontario were settled.[2]

When we look at our wildlife today, we see that it has been changed and influenced by man to the degree that he has changed and influenced the environment. We can recognize that the arctic and alpine tundra, one of our major vegetational regions, has been changed hardly at all. The adjacent subartic and subalpine non-commercial forest has been changed principally as a result of increased human travel causing more forest fires. The great commercial forest area farther south has not lost its real character through being managed. When it was first penetrated fires swept unchecked, but now it is all protected. Cultivable lands, whether originally forest or grassland, have completely changed. Both they and the managed forest may be much better for a great many forms of wildlife than the original wilderness.

Some creatures thrive on change. We have more moose, deer, grouse, and probably even more coyotes than in Indian days. Fur species are easily managed.

Many small mammals and birds thrive better in fields and woodlots than in the virgin forest, provided we do not poison them with pesticides. Right now, for most of the game and fur species across Canada, the available harvestable surplus is seldom fully utilized. As we seek to foretell the future from the present we see that we are in no danger of losing our wildlife. It should survive wherever there is space, and there is going to be a great deal of space.

However, we cannot permit ourselves to project the present status of wildlife into the future. In most species the turnover is so rapid that the failure of one annual crop, for whatever cause, is immediately noticeable, and the failure of two in a row is a major disaster. The adjustment to the vagaries of nature has been established over centuries. It is when these are supplemented or intensified by man's destruction of range that the future of wildlife becomes uncertain anywhere near our homes. Man as a hunter is likely to be far less devastating to wildlife than man as a destroyer of habitat, sprayer of poisons and introducer of exotic animals. Some of these activities are recognizably associated with human population, wealth and mobility.

Despite the delight that most of our pioneers took in wildlife, in some circumstances it has been subjected to a hue and cry that is still going strong. The bear seen on the road still has to be hunted down, even if it has not destroyed any property. In pioneer days, bears, wolves and pumas were fearsome creatures, and the musket was kept loaded — and in a dry place. All sorts and descriptions of birds and mammals had vengeance cried upon them from the highest levels for all sorts and descriptions of crimes.[18] The Ontario Game Commission,[19] which in hearings all over the province on a multitude of set questions, asked what *other vermin* (in addition to an already extensive list) should be destroyed, reported that witnesses listed "the names of every bird and animal that is found in the Province from the Sparrow to the Beaver".

Even if the hue and cry is still set up occasionally, there has been a revulsion against this sort of behavior. We are far removed from the day when the first Hudsonian chickadee ever found at Toronto won first prize for the rarest bird shot by any boy at a Sunday School picnic. Even our attitude toward bears and wolves has been tempered by our contact with National Parks and Wilderness Areas where experience has taught many that these are not really fearsome creatures, and school children have learned to be proud that they are still with us.

The thought that a wild creature's place in nature was assured by protecting the life of individual animals, and the lack of understanding of how nature actually operated, have been apparent in organized predator control — another long-standing activity directed toward wildlife. We know now that where predator and prey have lived together for a long time a *modus vivendi* is worked out. Where a predator is introduced into a new environment and this process has not taken place, as with the sea lamprey in the Great Lakes, we must either remove it or wait out this evolutionary process of adjustment. Even more disastrous, however, is the introduction of a prey species for which there is no competent predator. It may destroy the environment, as rabbits have done on some oceanic islands. Millions of dollars have been paid in bounties on animals, some of which were doing us good, and none was actually controlled by our action. The removal of a wolf that had a niche in the natural community made way for the survival of a young wolf that would otherwise have died a natural death.

In some places, quite apart from hysteria based on folklore, there is a very real problem of animals conflicting with human economic interests. The truth is that the pioneer unquestionably suffered more from a hundred thousand passenger pigeons settling on his grain in the fall than he ever did from wolves and pumas, seen once or twice in a lifetime. In their day passenger pigeons had the two major attributes of a problem species of wildlife. They were very numerous, and they were capable of doing to the human economy some injury which, insignificant in the unit, became important in the mass. Many people become annoyed from time to time by something that some wild creature is doing, but annoyance and injury are two different things.

Economically, the various species of blackbirds are probably our biggest hazard. All across Canada these birds attack grains somewhere, whether it be planted corn in Ontario, newly sprouted peas in the Maritimes, green oats on the prairies, or other crops in an increasing variety of situations. The birds are adaptable and multiplying. No real solution is in view, and not much research has been done.

Another problem, even greater in individual cases, is caused by ducks in swathed grain on the prairies. It is complicated over the whole continent by the fact that ducks are protected to provide sport.

These are merely the simplest and most obvious examples of conflicting interests. Man and wildlife impinge on each other constantly and we may expect to be confronted by problems from time to time. In sharing space we and our domestic animals share, with wildlife, food and other plants, diseases, parasites, drought,

flood, climatic extremes, industrial and domestic pollution, residues of pesticides, and atomic fall-out. The more we know about wildlife, the safer we will be. We might, through the sensitiveness of the wild creatures to changes in the environment, be made aware of some of our own problems and perils.

One of the most important requirements in assessing the significance of wildlife is a knowledge of how it is used and how this use is changing.

The United States Department of the Interior[22] carried out a nationwide household survey to find out who hunted and fished. They found that ten per cent of the population over 12 years of age hunted, and 18 per cent fished. Unpublished results of a recent household survey in Ontario indicate that these figures apply fairly closely to Canada, with some evidence that we may have slightly fewer hunters, and slightly more fishermen. We can thus say that there are at least 1.5 million hunters in Canada.

Hunters in the United States spent nearly $1 billion in the survey year. Canadian hunters, then, should spend close to $100 million a year. We cannot help feeling that our hunters are less lavish. For one thing, more of them live close to their sport. However, British Columbia authorities[11] estimated close to $6 million for their hunters, not quite 90,000 in the year concerned. A recent unpublished Ontario mail survey showed $7 million spent by about the same number of resident deer hunters. If we settle for about $7 million per 100,000 resident hunters, on the skimpy evidence available, we would get a figure of $105 million for 1.5 million hunters. This is in remarkably close agreement with the estimate based on the United States figures. It is big business. Later the question is raised whether any such figure can measure the real value of wildlife to our country.

All of this, of course, takes no account of the tourist trade. How much do Ontario's 390,000 non-resident anglers spend? We know that they spend $2¼ million for licences alone. In the same province some 4,000 *Yankee* moose hunters pay over $400,000 for licences alone. For no province, however, do we know what tourist hunters and anglers actually spend, nor do we have the foggiest idea what the total monetary value of wildlife is in the tourist trade. The late Dan McCowan, who was associated with the tourist trade at Banff for many years, told me once that he ran a check at Banff to find out what tourists wanted most to see, and they were practically unanimous for bears. On that basis those of us concerned about wildlife could lay claim to most of the tourist trade of Canada.

It would be foolish to ignore the tourist trade in dealing with wildlife, but at the same time I do not want to play it up. Of course there is an enormous future for tourism here, but in any conflict of interest over wildlife the future of our own people must receive first consideration.

Actual changes in pressure on wildlife are difficult to assess, because the only measure is licence sales and these are of varying value and all recent.[17] The increases in hunting pressure run in the order of three to four times for periods in which population has doubled. Ontario's increase is five times, and Alberta shows the greatest, about ten times. This increase in hunting, which does not parallel population growth, undoubtedly does follow the increase in real wealth.[3]

As in the United States, urbanization is a feature of all our growth. There is no recreational hunting in cities. Can there by any in metropolitan areas? Even as I write, in October 1960, the newspapers record that another Ontario township has become urbanized. It is, to all practical purposes, the fourteenth since the war. Where do we go from here?

I find myself relying, for my estimate of the future, on Clawson[4],[5],[6] who has been at great pains to get the best — and statistically soundest — picture of the future, based on present trends. What he has to say applies to the United States, but can unquestionably be projected to Canada.

Some time before the end of the century, our present population will have doubled. That is not the most significant thing. Real income per capita will be higher. The only argument among economists is as to how much higher. Further, where now two-thirds of the population live in cities, at the end of the century it will be four-fifths. The growth is going to continue where it is going on now. It is likewise highly probable that these more numerous and more affluent citizens of the future are going to work shorter hours and fewer days, and will be more mobile. In our terms, they are going to have far more opportunity than we have for outdoor recreation. The holiday traffic toward faraway places is sure to be intensified, but the real pressure will be for so-called *day-use* recreation to fill the spare hours of the working day and the spare days of the working week throughout the year. Clawson[4] estimates a ten-fold increase in the demand for outdoor recreation.

One might wonder whether wildlife should ever be expected to enter into the recreational life of urban man. Wildlife managers have noted that interest in hunting, as indicated by licence sales, has increased along with urbanization and they predict that the already evident trend will continue.

If population growth takes place mainly where it is already taking place, then clearly there will be hundreds of thousands of square miles of wildlife lands left in the rest of Canada. We can rejoice in this and plan to make the best possible use of them. At the same time we have to admit that they cannot possibly meet the needs of the vast majority of our future citizens, who will live in the expanded metropolitan areas. The *holiday lands* requiring more than a day's trip to use, will, however, be no more accessible to them than to tourists from the United States. How attractive these lands will be to our own people or Americans depends on how well we maintain their intrinsic attractiveness.

Is there going to be any wildlife land within or near our future metropolitan areas? Clawson[4],[5],[6] again gives us the answer. A metropolitan unit dominates the land use of a much larger territory, most of which is open. We must remember that in 50 years U.S. agricultural output has doubled, though acreage is smaller and the labor force much smaller. This trend will intensify so that in the future fewer farms will produce from a still smaller acreage all the food and fibre needed by a larger and richer population. Within a metropolitan region growth not only takes the urbanized area out of agriculture, it also takes out those lands that are not rich enough to justify the intensive farming methods necessary for such an area in the future. A metropolitan area can be expected to produce more food than the same area entirely in farm land, and still have unfarmed open land. Surely such land is recreational land, and under proper management most of it can be used for hunting, and so, under adequate controls, can the good farmland.

We cannot have hunting for the masses if we do not plan for it. It is evident that the urge for hunting and angling is ever present. Wealth, leisure and mobility release it. Having no place to go is like a *wet blanket*. Hitherto, Canada has been noted as a place to go for tourists. Will our own people think of it so, or will they anathematize us for sacrificing wildlife lands on the altar of greed, with the thought that there is always another place?

One effect of this sort of questioning might be that we will revise our concept of which are the richest parts of Canada. The man who lives with the out-of-doors at hand's reach might find the money gained by moving to the city poor recompense for the change.

The kind of wildlife administration that we know has no parallel in the European traditions of our ancestors. Theirs grew out of the feudal system, but here were no manors or parks with rights of chase and warren. We have the common law, with all wildlife belonging to the Crown, and our game laws are recognizable lineal descendants of the English game law, but our land was open and our wildlife free. As the old world game laws were largely preoccupied with keeping people from killing game, so our people inherited the idea that this was the answer to any shortages. As we have seen, abundance and shortage may alike have nothing whatever to do with the presence or absence of hunting. Where species protection does not work, recourse is made to forbidding all hunting in a specific area. Here again, hunting may not have been a factor at all. Early game laws were generally made or changed following a decline of game. Recognition of the fact that other factors are at work is nowadays reflected in a loosening of restrictions and rescinding of preserves, including some for which our fathers strove valiantly.

It is not enough for us to recognize that our fathers made mistakes. After all, their actions were at least positive. At first game laws were enforced by police officers, or by informations laid by citizens. When this was not enough, salaried officers were added, and it was the senior men of this class who in their time brought in biologists and technicians to determine the truth about wildlife numbers, after it became clear that there was more to wildlife management than total or partial protection from hunters.

Wildlife administration in Canada was, for a long time, an attempt to apply everywhere the philosophies engendered by the loss of the passenger pigeon and the buffalo, and the decline of the trout fishing in the back forty. We protected, fiercely, the creatures we loved. In fact, until there were five times more buffalo than there should have been, we wouldn't even kill the surplus in our large fenced enclosures – buffalo slums full of diseased and degenerate animals. We established preserves, often with no control over either land or water. We stocked pheasants and Hungarian partridges, regardless of their chance of survival, and, where they did survive, allowed years of harvestable surpluses to go down the drain through unnecessary protection and because we didn't know a surplus when we saw one. After paying millions in bounties on predatory animals, we then had to turn around and control rodents. Behind all this obsession with protection is a real history of unethical hunting and angling that still continues despite the resentment of the conscientious majority. Obviously, however, our administrative procedures toward wildlife arose from the popular interpretations of past misfortunes.

Only recently have we been influenced by science in our procedures. The science of animal numbers is new. Its basic concepts seem sometimes to run counter to popular prejudice, but it is hard to see why this

should be so. Any area will support only so many animals. Trying to pack more into it is like trying to put more water into a full bucket. You can sometimes do something about the bucket, but not always. Species that are highly productive must have a quick turnover. Wildlife must never be separated in our consideration from its environment. If the environment is fully stocked the annual increment need only replace the losses. All extra is surplus. Predators, more often than not, take only a part of the surplus, and man, if the animal is a game species, probably takes only a fraction of the remaining surplus.

In trying to establish our perspective on the future of wildlife in Canada, we start off with the knowledge that it is normal for Canadians to accept and treasure wildlife in their own vision of the future of our country. The question is whether in the places where we put on the fatty tissue of prosperity, we can retain health, grace and dignity, and make our dreams come true. We are not of the company of visionless peoples, doomed to perish. What we lack is the prophetic touch whereby we may see our way to a clear judgment, in the conflicts of our vision of nobility and beauty with our tremendous vision of prosperity and progress. Will our descendants bless us or curse us for what we are doing to our land? In Schwab's imaginative book about conservation,[20] the Austrian novelist and poet introduces us to the Devil, who takes a satanic delight in the pollution of air and water, the destruction of soil, forests and wildlife, and above all, the denigration of the human spirit and the breaking of contact between man and nature. His Infernal Majesty, who appears to his interviewers rather like a ruthless and philistinic type of business man, reminds us that his task is to bring about the downfall of mankind, but that man himself must be the active agent. He has learned to rely largely on Progress, and the finest satanic victories have been made to the accompaniment of loud and virtuous human plaudits.

If wildlife does lose its place in our lives, it will not be because we have no scruples about it, or because we do not want our pride in progress to be unalloyed with doubts and reservations about lost values. It will be because our inner voice lacks both the power and eloquence to cry down the sacrifice of a permanent value to a *fast buck*. It is one thing to have ethical and moral reservations and another to invoke ethical and moral sanctions. We who are interested in the perpetuation of wildlife and wildlife areas claim intangible values as against the hard cash that may be involved in closing the gap between developing and despoiling. Some of these may not be completely intangible. Marchionini,[16] in justifying a nature preserve program, showed that there are diseases such as coronary thrombosis, cancer and diabetes inescapably linked with modern life, for which the incidence among those who still live close to nature is startlingly lower than for the rest of us. The therapeusis of Nature is not in doubt; the question is only the size of a useful therapeutic dose. The mentally ill now fill more than twice as many of our institutional beds as they did a few years ago. There may be many for whom very little more contact with Nature would have relaxed tension enough to make the difference. We live in a cultural environment that provides increasingly for the institutional bed, and once our hospitalization schemes are set up by law the money has to be found. When the amounts frighten us, it is possible to make some economies by cutting off funds that might provide scope for recreation, and for the preservation of nature. Do we not owe it to our society to look toward keeping the bed empty as well as paying the cost of its occupation?

These intangible benefits of contact with nature may be less elusive in the long run than a true assessment of the hard cash involved in outdoor recreation. True it is that the amount spent in bringing a deer to bag is as legitimately balanced against the cost of having it there to hunt, as is the price of a roast of beef against the cost of production. But how much of what the hunter spends is tied in with the vanity of gadgetry, and status-seeking assertiveness in private transportation and accommodation, all of which does nothing more than extend the roots of stress and neurosis out in the country? Is true value to be measured in dollars?

Incidentally, one of the most striking things reported from all provinces is the multiplication in the last few years of nature students, bird watchers, nature photographers and the like. Once a handful, they are now legion. Because they are as much lone wolves as the hunters but do not buy licences, we learn only by accidental illuminating flashes just how numerous they are. In Toronto, for example, the naturalists imitated the weather service, and put taped reports on bird migration – changed every few hours – on a special telephone number. With two lines they thought they were being extravagant, bearing in mind their modest paid-up membership, but to their utter amazement the lines were promptly jammed with calls which backed up into the main channels of the dial system and overflowed into open lines in the most extraordinary places. The service had to be discontinued because the facilities could not stand the pressure. Who were all these people? They were the public, the people who are disposed

of by the rhetorical question, "Do you ask us to believe that anybody really cares about such things?", when the question of going to a little trouble or expense in saving a marsh, a woods, or a shore line comes up.

We have a conscience about wildlife, but it is still, for the most part, a private conscience. As a public conscience is never more than an upwelling of private consciences, we have the basis of wildlife conservation. Conscience needs to be developed into a personal ethic and a sense of national responsibility. Then, if we may expand Fudalla's concept,[10] all our natural resources are seen as a trust, for which it may be said, as the Apostle said of the Sacraments, that he who eats and drinks unworthily eats and drinks damnation.

We can all take heart from a stated opinion of Douglas[7] on a case before the United States Supreme Court: "The concept of the public welfare is broad and inclusive. The values it represents are spiritual as well as physical, esthetic as well as monetary. It is within the power of the Legislature to determine that the community should be beautiful as well as healthy, spacious as well as clean, well-balanced as well as carefully patrolled."

References

[1] Adams, A. Leith. *Field and Forest Rambles*. Henry S. King & Co., London. 1873. pp. 333

[2] Clarke, C.H.D. *The Bob-white Quail in Ontario*. Ontario Department of Lands and Forests. Technical Bulletin, Fish and Wildlife Series, No. 2. Reprinted from Bull. Fed. of Ont. Nat., No. 63. January 1954. Toronto. pp. 11.

[3] Clarke, C.H.D. *Hunting and Fishing in Canada's Future*. Trans. 46th Conv. Int. Assoc. of Game, Fish and Cons. Commissioners. 1956. pp. 25 – 31.

[4] Clawson, Marion L. "The Crisis in Outdoor Recreation". Resources for the Future, Inc., Washington, D.C., Reprint No. 13, from *American Forests*. March 1959 and April 1959. pp. 20.

[5] Clawson, Marion L. *Soil Conservation in a Dynamic Society*. Proceedings of the 15th Annual Meeting, Soil Conservation Society of America, Ontario Agricultural College, Guelph, Ont. 1960. pp. 16.

[6] Clawson, Marion L., R. Bernard Held and Charles H. Stoddard. *Land for the Future*. Johns Hopkins, Baltimore, for the "Resources for the Future, Inc ". 1960. pp. 570.

[7] Douglas, Justice William O. *Opinion in Berman v. Parker*. No. 22, October term 1954. 348 U.S.C. 26. 1954.

[8] Doyle, Martin. *Hints on Emigration to Upper Canada*. William Curry, Jr. & Co. Dublin. 1834. pp. 92.

[9] Dunlop, William. *Statistical Sketches of Upper Canada for the Use of Emigrants*. John Murray. London. 1832. pp. 120.

[10] Fudalla, S.C. *Die Gegenwart als Patient*. Alfred Scherz. Bern. 1960. pp. 308.

[11] Hatter, J., D.J. Robinson, P.W. Martin, L.G. Sugden, E.W. Taylor and W.G. Smith. *Inventory and evaluation of wildlife resources of British Columbia*. Reprints from Transactions of the 9th British Columbia Resources Conference, B.C. Game Commission, Vancouver. 1956. pp. 42.

[12] King, Major W. Ross. *The Sportsman and Naturalist in Canada*. London. 1866.

[13] Levigne, R.G.A. *Echoes from the Backwoods*. 2 Vols. London. 1846.

[14] Lloyd, Hoyes. *Some Canadian Remarks on Waterfowl Conservation*. 14th Annual Convention of Izaac Walton League, Chicago. April 16 – 18, 1936.

[15] Magrath, T.W. *Authentic Letters from Upper Canada with an account of Canadian Field Sports*. William Curry, Jr., & Co. Dublin. 1833. pp. 334.

[16] Marchionini, Alfred. "Gesundheit, Freizeit und Naturpark" in *Naturschutzparke*, Vol. 17. February, 1960. pp. 3–10 pub. Ver Naturschutzpark E.V. Stuttgart.

[17] Munro, D.A. *Legislative and Administrative Legislation on Wildlife Management*, a paper prepared for the 1961 Resources for Tomorrow Conference.

[18] Ontario Agricultural Commission. *Report*. Published by C.B. Robinson. Toronto. 1881. pp. 619.

[19] Ontario Game and Fish Commission. *Report*. Published by Warwick & Sons. Toronto. 1892. pp. 483.

[20] Schwab, Gunther. *Der Tanz mit dem Teufel*. Adolf Sponholtz, Hannover. 1958. pp. 492.

[21] Senate of Canada. Report of the Committee appointed to enquire into the resources of the Great Mackenzie Basin. Ottawa. 1888.

[22] U.S. Department of the Interior. *National Survey of Hunting and Fishing*. Fish and Wildlife Service, Circular 44. Washington, D.C. 1955.

The Economics of the Fur Industry in Canada

A.G. Loughrey,
Head, Game Management Service, Territorial Division, Northern Administration Branch, Department of Northern Affairs and National Resources, Ottawa.

The organized fur trade in Canada was started in the latter half of the 16th century by the French along the lower St. Lawrence. The British, with the formation of the Hudson's Bay Company in 1670, established trading posts on the shores of Hudson Bay and James Bay. The latter half of the 17th, and the 18th century was a period of rapid expansion of the fur trade and explorations were made to the west and north.

After 1760 the British took over the fur trade from Montreal, with the formation of the North-West Company, and continued to compete with the Hudson's Bay Company. The two companies merged under the name of the latter in 1821. By the beginning of the 20th century the Hudson's Bay Company had established a chain of fur trading posts from the Atlantic to the Pacific and north to the Arctic Ocean.

The production of raw fur depends not only on biological factors, but also on the economic factor of demand. Biological factors which limit the production of wild fur include reproductive success, the availability and quality of habitat, food and cover, inter- and intraspecific strife, and mortality. Ranch fur production is determined primarily by demand.

The supply of trappers is partially determined by the profit motive and is greatly influenced by fur prices. Trapper incentive, however, is influenced indirectly by various socio-economic and cultural factors. The number of ranchers is limited primarily by economic considerations; and profit squeeze, resulting from stable product prices and increasing production costs, appears to be the most important factor.

Extensive research on wild and ranch fur species has been undertaken chiefly by federal, provincial, and university agencies. There is a requirement for additional research in the studies of diseases, genetics, and ecology. Management programs for wild fur species have been concerned primarily with habitat management, restocking, and the setting of seasons and quotas.

The fur industry consists of production, marketing, processing, manufacturing, and retailing divisions. Many of the firms within these divisions are undercapitalized and are susceptible to a profit squeeze. The industry as a whole is highly competitive, and is not concerned with management of the basic resource. At the retail level unsound advertising practices, product variability, and untrained sales staffs tend to negate the product's luxury image and promote unfavorable consumer reaction.

The industry in Canada has not grown with the economy since the Second World War and has been subject to both short term instability and long term decline. One of the problems has been fluctuation in the supply of the resource. Consumer demand for fur goods emerges as the most important single factor in determining the success of the industry.

The decline in production and export of Canadian furs, particularly wild furs, during the last decade is not attributable to a decrease in the supply of the resource, but to a decrease in the number of trappers. The decrease in the number of trappers appears to be largely the result of decreased raw fur prices, which are a reflection of decreased demand and increasing competition from ranch fur, foreign fur, and the synthetic fur industry.

A management program for the fur industry must be drafted on an industry-wide basis to cope with the problems of the primary producer, the increasing competition in the international fur market, and the ultimate problems of stimulating consumer demand for fur goods. It behooves the fur industry as a whole to undertake an aggressive program of market research, product development, and product promotion.

The Canadian fur trade began under the French regime and was first centred around Quebec, Tadoussac, Three Rivers, and Montreal. The French initiated the system of packaging furs for shipment to France and receiving trade goods suitable for the primitive requirements of the aborigines.

As trade in the new world developed, the European marketing organization, prompted by the increased demand for beaver skins for felt, improved its ability to handle furs and trade goods. As demand for furs increased, so did competition between rival traders, which in turn led to the exploration of increasingly remote areas.

After 1760 British traders assumed control of the fur trade out of Montreal. They formed the North-West Company, which competed vigorously with the older Hudson's Bay Company. Competition between the North-West Company and the Hudson's Bay Company was finally ended by the union of the two companies under the name of the latter in 1821. The reorganized company extended its sphere of influence from the Atlantic to the Pacific and northward to the Arctic Ocean. (16).

Development of the fur trade in Canada depended on certain biological and physical factors. The prime prerequisite was a plentiful natural supply of suitable fur species such as beaver, otter, muskrat, marten, bear, fox, lynx, fisher, mink, and wolf. Also important were vast land areas drained by navigable watercourses, and an aboriginal population of nomadic hunters. Another essential factor was the availability of *country resources* such as fish, moose, deer, buffalo, corn, and maple sugar as staple food supplies for the traders and voyageurs. (21)

The industrial revolution had important effects on the fur trade. It resulted in improved facilities for processing and manufacturing finished fur products and increased production of cheap trade articles, such as woollen cloth, hatchets, kettles, firearms, powder, flints, knives, awls, and powder horns.

It is significant that British success in the fur trade can be partly attributed to the discriminating consumer demand of the Indians. The production of superior goods, notably woollen cloth, was a direct result of the better British industrial methods. This advantage outweighed the French advantages of earlier entry into the fur trade and greater skill in dealing with Indians.

Much of the economic development of Canada owes its beginning to the impetus received from the growing demands of a fur trade which embraced the nation. The role of the fur trade in the establishment of Canada as a member of the British Commonwealth and the part it has played in establishing Canadian sovereignty, particularly in the Arctic, must not be overlooked.

Raw Fur Production

The average annual value of raw fur production in Canada during the 10 year period 1950 to 1959 was $25.7 million. In 1958-59 the total production of raw furs in Canada was 5.3 million pelts with a value of $25.8 million. The value of wild furs was $9.7 million and ranch furs $16.1 million.

Factors affecting the production of wild fur

The supply of wild furs available to the fur industry depends on the supply of fur species available for cropping and the number of trappers available to harvest the crop. A number of biological factors control the supply of fur species: the availability of habitat, the size of the breeding stock and its reproductive success. (23) The latter two factors in turn depend on a number of limiting factors which include: intra- and interspecific strife, availability and quality of food and cover, and mortality factors such as predation, incidence of disease and parasites, and human utilization. All of the above factors tend to be seasonally variable.

Certain fur species are subject to non-seasonal variations in their numbers, and these fluctuations are frequently the result of density-dependent factors. (9, 10, 32). These species, usually referred to as *cyclic species*, include, arctic fox, muskrat, lynx, and marten. (5, 6, 8, 11, 12) The population fluctuations of predators closely depend on the population fluctuations of the prey species, such as lemmings and hares, which demonstrate wide variations in their population densities. As could be expected, the build-up and decline of predator populations is slightly out of phase with the population fluctuations of the prey species. (13)

Factors affecting the supply of trappers

Recent figures indicate that 54,000 persons are engaged as full or part-time trappers in Canada. The number of trappers or primary producers available to harvest the fur crop is related primarily to the profit motive, or the expectation of reasonable financial returns for efforts. This in turn depends on the sum of biological, economic, and cultural factors.

The biological factor is represented by the available supply of the fur species. The economic factor is related to the current and anticipated market prices of those species. During periods of peak abundance of fur species or of high prices, trapper interest is at its peak, while the reverse is true for periods of scarcity or of low prices.

The socio-economic factors which influence the supply of primary producers include: the availability of alternative sources of employment, the wages paid, and the availability of suitable trapping areas. The number of trappers may also depend on such factors as the encouragement that they receive by way of outfitting advances, advance information concerning the abundance of fur species, and anticipated market prices. In some cases direct assistance, in the form of recoverable advances, is provided to trappers by govern-

ments. These may be provided at the beginning of the trapping season to enable them to reach areas difficult of access, or after trapping is finished but before the furs are sold. Governments may also help trappers by assisting them to take in their supplies and resupplies to the trapping areas and by opening roads or trails. Certain less tangible factors, such as the availability of *country resources,* also influence the movements and relative success of the trappers in the field. (4)

The trapper's incentive is, as noted, primarily related to profit. An important factor in recent years has been the *profit squeeze* which has resulted from stable or decreasing fur prices and increasing costs for outfitting with traps, boats, fish nets, motors, dog team, or motorized sleds.

Cultural factors, although less tangible than biological or economic factors, are nonetheless important in influencing the supply of trappers and may even prevent some men from entering the field and seriously curtail the full-time activities of others. In general, there has been a trend away from primary production toward urbanization and wage employment, with resultant changes in our values system. (9)

Our educational pattern, with its long summer holidays based on the agricultural regime even for people who primarily depend on a hunting and trapping economy, has a marked effect on the distribution and settlement of the trapper population. While trappers' children require improved educational opportunity, it should be possible to arrange the curriculum so that the family unit could be together during the trapping season. At present there is a growing trend for trappers to remain in the settlements so that their children may attend school. As a result, trappers only go out to their lines for short periods when the economic returns are greatest. Thus many good areas are neglected for most of the year. In many provinces and territories the areas of difficult access are not being harvested.

Research on wild fur species

There is a need for both basic and applied research in the fur resource field. This need does not appear to be fully recognized, however, by many segments of the fur industry. By and large, research is left to the federal, provincial, and university research agencies.

Basic research for most fur species has proceeded along standard lines of taxonomic, life history, physiological, ecological, food, habitat, and population studies. (25)

A review of published material indicates that research on applied trapping and fur-handling techniques, particularly with reference to the stated preferences of the fur market, has been almost entirely neglected. In addition, the basic and applied research on genetic and ecological factors which effect the quality of fur have not yet been undertaken.

Management of wild fur species

Management of wild fur species has been largely the responsibility of government agencies. Management programs have involved chiefly habitat management and the setting of seasons and quotas. The principles of habitat maintenance, improvement, and protection have been fairly well worked out and may be applied to farm, marsh, taiga, and tundra habitats. (19, 20)

Resolving conflicts between multiple resource utilization, such as timber management versus fur management, has been difficult. As a result of the trend toward increased use of marginal and waste land areas, this problem will grow rather than diminish. This is an essential subject for both research and experimental management.

Management programs aimed toward preserving breeding stocks of fur species include the establishment of wildlife reserves, parks, and sanctuaries. In addition, breeding stocks are protected by closed seasons and the establishment of zones and quotas. In most provinces, restocking of *trapped out* areas has proven successful for species such as beaver, muskrat, and marten, particularly when adequate environmental studies have been undertaken first. In some cases these studies have indicated the necessity of planting suitable plants and animals to provide cover and food for the intended fur species. Protective legislation, often difficult to enact and even more difficult to enforce, has been successful in regulating harvest techniques by prohibiting the use of poison, land-set snares, shooting, and other wasteful practices.

It sometimes seems that management agencies were once too pre-occupied with *bringing back* certain valuable fur bearers. Now concerned with promoting the optimum harvest of fur species, they are often thwarted by economic factors which prevent the removal of surplus crops from remote areas and find themselves requiring methods for controlling and harvesting overpopulations which resulted from their *conservation* programs.

Factors influencing the production of ranch fur

In 1958 there were 2,572 fur farms operating in Canada. The basic problems of fur farming are similar to those of trapping. However, because of the greater capital investment in breeding stock, equipment, and facilities, economic factors are much more important.

The fur rancher's motivation is the same as the trapper's – the expectation of a reasonable profit. Economic considerations restrict the rancher to raising only those species whose pelts have a relatively high value, and which can be raised readily in captivity at a cost which will allow a reasonable profit. (22) Many ranchers derive a considerable profit from the sale of breeding stock, as well as from the sale of pelts. Although ranchers compete with Canadian trappers, their chief

competitors have been foreign ranchers. This is increasingly apparent in the competition that Canadian mink ranchers are facing from American and Scandinavian producers.

The rancher is extremely susceptible to the *profit squeeze* due to his large capital investment. During the past decade he has been confronted with stable or decreasing prices for his product and increasing production costs for feed, pens, labor, and transportation. This combination of factors has resulted in the virtual abandonment of the once flourishing colored-fox ranch industry in Canada.

The biological problems of the ranch fur industry are, in many respects, similar to those of the wild fur industry. Only certain fur species, due to their habitat requirements and behavior, are suitable for ranching. Aquatic species and larger carnivores do not lend themselves to domestic ranching. The ranchers, however, have strengthened their competitive position in the market by developing mutant color phases, primarily of mink and, more recently, nutria. The availability of breeding stock is an important limiting factor in ranch production, particularly when a new strain or colour phase is in demand. When this occurs, the sale of breeding stock is extremely profitable.

Research on ranch fur

Very little applied and even less basic research has been undertaken by individual fur ranchers, principally because the profits of the individual operation are not sufficient to support full time research facilities and programs. Research at the group level has been restricted to the fields of nutrition and developing new strains.

Research by government and university agencies has been directed primarily toward disease, reproductive, and nutritional studies. Research on disease control has made progress, and in recent years several effective inoculations to combat specific diseases common to ranch species have been developed. Recent studies of dietary requirements show promise of providing a standardized, cheap, and satisfactory food.

Management of ranch species

As a private enterprise the management of fur farms has been left largely to the individual owner. Handling and production techniques, such as housing, feeding, breeding, and pelting, evolved by trial and error, but now have become more or less standardized and quite efficient.

Several factors are important in the choice of an area for a fur-ranching enterprise. Climate is very important, particularly for the densely furred northern species such as mink, marten, and foxes. With increasing production costs, the availability of a satisfactory source of cheap food has become a decisive factor in determining location.

The Economic Aspects of the Fur Industry

The fur industry is composed of several segments, each performing various functions essential to production of the finished goods. These segments include production, marketing, processing (dressing and dyeing), manufacturing, and retailing. (1) Each segment has problems peculiar to its particular operation and function.

The fur industry in North America has failed to grow with the rest of the economy during the postwar period. It has been subject to the unsettling effects of both short-term instability and long-term decline. One of the basic problems has been fluctuations in the availability of the product, as a result of catastrophic declines of wild fur species due to drought and epizootics. Fluctuations have also occurred in market prices and retail sales. These fluctuations in both supply and demand have had a disruptive effect on the entire industry.

Fuchs, in his study, has pointed out that the fur industry is an extreme example of an *atomistic* industry as opposed to a monopolistic industry (15). It is composed of numerous small firms, many of which are woefully undercapitalized. As might be expected, these firms are very susceptible to a profit squeeze in the face of relatively stable product prices and increasing costs of equipment, labor, and shipping.

The success of the fur industry depends on consumer demand, and, at the retail level, fur wearing apparel is competing for consumer discretionary spending. As a functional product, furs are purchased for warmth and must compete with cloth and the new synthetic pile fabrics. As a luxury product, furs must compete with an ever-increasing number of consumer goods and services such as: cars, boats, appliances, and vacations.

The stimulus to product consumption is product promotion. This must be clearly recognized and supported on an industry-wide basis.

Marketing of Raw Furs

Primary producers in remote areas, particularly Indians and Eskimos, have traditionally sold their furs to a local trader or an itinerant fur buyer. When demand was high and there was considerable competition for furs, the trapper profited. This system led to abuses by certain trappers, such as receiving an outfitting advance in the fall from one trader, and selling the furs in the spring to another trader, with subsequent failure to meet debt obligations. The system also led to abuses by some buyers who reached the trapper on the trapline and bought only the best skins at the lowest prices. Since 1945 conditions have changed, and in

most settlements there are now only one or two fur traders. The trapper is subject, therefore, to monopoly control in the selling of his furs.

Trappers are aware that they can usually obtain better prices by selling their furs by auction, but two factors usually deter them. First, they require money, which they usually do not have, to pay fur export tax and shipping charges, although they may sell some of the poorer skins locally to cover these expenses. Second, the trapper receives his money from the auction house only when the skins have been sold, and few trappers can afford to wait that long.

In some localities, notably in Saskatchewan, trappers have formed co-operatives which pay the trapper a percentage of the value of the fur and then ship the furs to the auction houses. When the furs have been sold, the trapper receives the final payment for his furs, less a deduction for the operating costs of the co-operative. This system has proven to be very satisfactory, since the initial payment allows the trapper to re-outfit and return to his trapline.

The local fur trader, of course, often objects to the trappers' co-operative. He contends that he supplies the retail products without which the trapper could not outfit himself, and since the cost of maintaining a large inventory in a remote location is high, he must have the fur trade to stay in business. The trend toward trappers' co-operatives, however, appears to be gathering momentum across the remote sections of Canada. The fur trading industry is once again facing competition, but of a slightly different nature.

The ranchers, and the more sophisticated trappers in the less remote areas often sell their furs directly through one of the large auction houses. There are seven auction houses in the major cities of Canada, Montreal being the most important. Their fur sales are held on prearranged dates for Canadian, American, and European buyers. The bidding is based on anticipated manufacturers' requirements and is highly competitive. The current demand, and the prices received by the auction houses for raw pelts usually determine the prices which are paid to the trappers and ranchers for their next crop. The auction houses handle large volumes of furs very efficiently, and it is unlikely that any major improvements can be made at this level of the industry.

Furs are traded on an international market and prices are thus established on the basis of international supply and demand. The chief auction houses are located in London, New York, Montreal, and Leningrad.

A large proportion of Canadian furs are exported. In 1958 the value of raw furs exported was $24.9 million. During the same period raw furs valued at $24.5 million were imported. The main export species are mink, beaver, and muskrat. The chief import species are Persian lamb, mink, and muskrat.

Since 1945, the volume and value of foreign fur production has become of increased significance. Most foreign countries are actively promoting their products on the international market. For example, it is estimated that Scandinavian auctions will offer three million mink skins next season, nearly three times the total production of Canadian wild and ranch mink. The funds for promotion of these furs, under the trade name *Saga*, are raised by a levy of 0.85 per cent of the sale price, deducted from all skins at the auction level. (2)

The annual production of Persian lamb from Africa is some 3.8 million skins, and a vigorous publicity campaign in Europe is financed by a levy on each skin produced. (30)

Processing and Manufacturing

Fur processing consists of dressing and dyeing the raw pelts in preparation for manufacture. In common with fur manufacturing, this branch of the industry has certain problems which are ultimately reflected in fur garment retail prices, and therefore these two segments will be considered together.

In Canada in 1958 there were 14 fur-processing and 493 fur-manufacturing establishments employing 900 and 4,300 persons respectively. These industries are frequently undercapitalized and must operate on loan capital. (31) In addition, labor problems, particularly in the manufacturing segment, have greatly increased their difficulties. Labor now accounts for 25 per cent of the cost of manufacturing, and the cost of skilled labor is increasing. The labor unions demand better conditions of work, overtime payments, and the hiring of extra help. (33)

Most processing and manufacturing firms are small. They can take little interest in creating fashion changes, because they cannot afford to experiment with their limited capital. (27) They have shown no interest in the conservation and management of the resource.

Manufacturers do not normally engage in the retail field. Their finished products are consigned to the various retail outlets through store buyers or jobbers. The larger firms may deal directly with the buyers of large retail stores; while small manufacturing firms rely on jobbers who sell mostly to the smaller retail outlets at a markup of about 15 per cent. Manufacturers may determine the market price of their garment by calculating the cost of materials, labor, and overhead and arrive at a cost per item by taking into account differences in quality, or they may price each garment on the basis of its estimated value in the current market. The manufacturing segment of the fur industry is highly competitive, and there appears to be considerable distrust between buyers and manufacturers. (15)

Consumer Demand

Fur garments are worn for warmth and as a luxury item. In the latter capacity furs have come to be regar-

ded as a status symbol. Consumer demand for furs as functional apparel, as might be expected, is greater in colder climates. Canada provides above average demand for fur apparel for functional use. Throughout the world, consumer demand for fur as a luxury item seems to have followed the increase in real wealth and social mobility.

Consumer demand for furs is based largely on taste, which may be stimulated and altered by fashions. To this extent the industry is highly manipulative. Consumer tastes and fashions may be dictated by style or design changes. The long-hair, short-hair fur cycle is a familar style change. More subtle changes in style, such as coat length, fullness of cut, and trim, can exert a strong influence on consumer demand.

Fuchs has shown, however, that the single most important factor in determining consumer demand appears to be a rather intangible force which can be stated as "expectation of an economic upturn" on the part of the potential consumer. The anticipation of good business appears to be a powerful catalyst in precipitating purchases of fur apparel. It has been noted that the buying cycle is apparently *contagious* during the early stages. (15)

Retailing

The annual value of retail sales of fur goods in Canada was $68.2 million and the value of storing, cleaning, and repairing furs $5.6 million, according to data from the 1951 decennial census. Fur garments may be retailed by specialty retail outlets, commonly known as furriers, or through the fur departments of large department stores. On the surface, the relationship between manufacturer, retailer, and consumer follows the normal pattern, but this phase of the industry is afflicted by internal conflicts, variability of product quality, injudicious advertising, and other unsound practices.

The average consumer reacts to price, style, versatility, quality, durability, and workmanship in about that order. Unfortunately, one of the basic faults of the fur retail business is that sales staff is frequently inexperienced and cannot offer helpful advice concerning these features to the consumer. This situation is particularly true of the department stores which account for the bulk of retail sales. (15)

Consider the case of *Mrs. Average Consumer* who has decided to buy a fur coat in spite of the multitude of other appealing luxury items which compete for her attention and her money, and in spite of the availability of a vast choice of smartly styled, less expensive, cloth coats and *hard to tell from real fur* synthetic-pile coats. If she peruses the fur advertisements she is already aware that furs may be purchased at *drastically reduced prices* during August clearance, preseason, postseason, intra season (January) and numerous other sales. In fact, furs are unique among luxury items because of the amount of price discounting that is featured in advertising. She will be cajoled and confused by the use of a host of exotic and euphemistic names for common and less expensive species which have been dyed and treated in different ways. The confusion will be compounded by the use of trade jargon such as *dropped* and *let-out* skins. After visiting several retailers, the consumer, if she is discerning, will probably correctly suspect that there is no quality standardization and no one-grade, one-price policy. She will discover that there is rarely a manufacturer's identification, which may seem strange to a person conditioned to buying *brand name products*. She may also be taken aback to learn that there is seldom a manufacturer's guarantee. If she already owns a fur coat she will be disappointed to learn that there is no organized trade-in policy and no standard installment plan. It is interesting to speculate what might happen to the sale of new cars if there was no organized trade-in market.

An Appraisal of the Fur Industry

The fur industry in Canada, from resource to consumer, is such a broad field that no one person or organization can adequately represent the various segments of the industry. It has been noted that the fur industry has not grown with the rest of the economy since 1945. If the whole economy of Canada and North America should recede for any extended period, the market for luxury items, such as furs, would undoubtedly suffer a sharp and severe decline.

In recent years there has been a decline in production and exports of raw fur and a slight increase in raw fur imports. The decrease in Canadian raw fur production is not due to a decrease in supply, for many wild fur species have been increasing in numbers and extending their ranges during the past decade under management measures. The problem of decreased production of wild furs is attributable to the decreased number of full and part-time trappers. This has been the result of decreased demand and lower prices for wild furs, and other economic and cultural pressures. The population of ranch fur species is artificial and it varies directly with demand for the various species.

Wildlife biologists, enforcement agencies, and administrators must stop viewing the fur resource from the narrow views of inventory, conservation of resource, and resource management. These agencies must become more aware of and sympathetic to the problems of primary producers; they must accept the significance of demand for fur on the international market. They can use their influence to strengthen and solidify the diverse segments of the industry from producer to consumer.

There can be no doubt, in the light of growing competition from foreign fur producers and the synthetic fur industry, that if market research, product development, and product promotion fail, then our primary producers will find their income depleted, and ultimately their way of life will cease to exist.

Governments should carefully appraise the present and future role of the primary producer. In Canada there has been a tendency for Federal and Provincial Governments to preserve the fur trapping rights for the aboriginal inhabitants and their descendents, particularly in the Northwest Territories, the Yukon Territory, and the northern parts of the provinces. Strong evidence can be presented to show that these people are not good *conservationists* and in many instances are not even good trappers. The fur resources of this country, like the forest, water, and mineral resources, belong to the nation and not to any specific ethnic group. The Provincial and Federal Governments must take adequate measures to ensure that the nation's fur resources are being managed and harvested to provide the optimum benefits. In the U.S.S.R. the production, buying, marketing, processing, manufacture, and export of fur are all controlled by the state. It is not likely that such a program would be either acceptable or feasible in Canada.

Governments are committed to the policy of educating the aboriginal people and preparing them for ultimate wage employment. (26) Adherence to this policy requires full consideration of its effects. The opportunities for wage employment for Indians and Eskimos at the present time are small (13) and for uneducated adults of these ethnic groups they are limited and remote. (4) These people are presently increasing in numbers and are likely to continue to do so. It may be 10 or 20 years or even longer before there are sufficient opportunities for them in wage employment in their native regions, or before a generation is sufficiently well trained and socially adjusted to compete in the labor market of the southern urban centres. During this transitional period, the majority of northern Indians and Eskimos will have to obtain a living, and nothing could be more damaging to their morale than to depend on welfare measures. Perhaps 80 per cent of the present generation of adults and perhaps a slightly smaller portion of the school age generation will, of economic necessity as much as by choice, turn to their traditional pursuits of hunting and trapping.

It is thus imperative that governments formulate a policy by which Indians and Eskimos will derive the greatest benefit from the fur resources. Government wildlife research and management agencies must concern themselves not only with the proper harvesting of the resource, but also with the capabilities of the people who are harvesting that resource. Different ethnic groups in various stages of social advancement will harvest the resource better under various systems. (27,3) For example, the registered trapline area may be suitable for one group where the resource warrants it and where the people have a social awareness of property ownership and management, but for other more primitive groups the concept of group area and group ownership may be the best suited for their needs. The formation and support of trappers' councils to foster concepts and responsibilities associated with group ownership and management must be encouraged. Trapper education programs should be increased in scope and function in order to teach improved trapping and fur handling techniques. (14) The role of the fur buying co-operative should be reviewed. The success of the Saskatchewan Fur Marketing Service requires study. A policy that is fair both to the trapper and to the trader should be outlined. In all these fields, the assistance of social anthropologists should be engaged.

It is not necessary to emphasize that game laws and regulations must be kept in accord with current wildlife resource policies and practices.

In the ranch fur industry, governments have offered aid by providing disease vaccines and have encouraged ranchers to establish in certain areas by guaranteeing a supply of cheap food. The various fur ranchers' organizations must continue in their efforts to promote uniform standards of production, exchange of information, and enforcement of a standard of ethics.

It is not overstating the case to re-emphasize that the ultimate problem of the fur industry is not one of supply but of demand. Greater emphasis and efforts must be directed toward increasing consumer demand, particularly in view of the competition to North American furs from foreign producers and the competition from the cloth and synthetic pile clothing segments of the apparel industry. To counter this situation the fur industry of Canada and North America must employ a dynamic, threefold approach to consumer demand, namely market research, product development, and product promotion.

A market research body representing the fur industry should aim at understanding the domestic and foreign markets for furs, broadening those markets, and supervising the co-ordination and orderly development of the fur industry from the producer to the consumer. The following questions should be answered: Who buys furs and why? Where are the chief markets? How much money is spent on furs? How often are fur coats replaced? What does the consumer really want? What new domestic markets can be developed? What is the extent of the competition to North Amercian furs from foreign furs? What new foreign markets can be developed?

In addition to understanding the market for furs, a market research agency should appraise competition

for consumer discretionary spending, in particular the competition to fur apparel from the cloth coat and synthetic fur coat, with a view to establishing short-term and long-term trends.

There is an immediate need for product development in the fur industry. It is possible that species that are not presently being exploited could provide additional markets for the fur industry, for example, an expanded use of the hair seal for sportswear. There may be other species that are adaptable to ranch production. The new technique of hair follicle grafting shows promise in providing new products at lower costs; this field should be investigated. There is need for the development, production, and promotion of various types of manufactured fur products, apparel for instance – hats, scarves, gloves, shoes, snow boots, slippers, sports apparel, and ski wear. The use of fur materials in the upholstery industry, for furniture and cars, presents a challenging opportunity for product development.

In the field of product promotion the present facilities are inadequate. This program more than any other requires active co-ordination, co-operation, and development. A commission or board should be established to engage in both domestic and foreign market promotion. It should represent the entire industry and be financed on an equitable basis. This agency should attempt to develop an industry-wide code of ethics. Canadian furs should be made the standard of quality. There is a great need for manufacturers' identification on fur apparel, standardization of names, and a manufacturer's guarantee. In the field of pricing of fur coats and other wearing apparel there is considerable room for reform, particularly in price advertising. Advertising should stress the product and the quality of that product rather than price reductions.

Economists advise us that North Amercia should attempt to develop its trade with other Western Hemisphere nations. The South American market may hold interesting possibilities for the sale of furs as luxury items. The buoyant economy of some of the Pacific nations, such as Japan and Australia, particularly since import restrictions against dollar goods have been lifted, should be investigated and the sale of Canadian furs promoted.

APPENDIX I

Table 1. Pelts of Fur-Bearing Animals Produced and Percentage of Value Sold from Fur Farms, Years Ended June 30, 1940–59.*

Year Ended June 30	Pelts		Percentage of Value Sold from Fur-Farms
	Number	Value	
		$	
1940	9,620,695	16,668,348	31
1941	7,257,337	21,123,161	26
1942	19,561,024	24,859,869	19
1943	7,418,971	28,505,033	24
1944	6,324,240	33,147,392	28
1945	6,994,686	31,001,456	31
1946	7,593,416	43,870,541	30
1947	7,486,914	26,349,997	37
1948	7,952,146	32,232,992	37
1949	9,902,790	22,899,882	33
1950	7,377,491	23,184,033	34
1951	7,479,272	31,134,400	36
1952**	7,931,742	24,215,061	42
1953	7,568,865	23,349,680	43
1954	6,274,727	19,287,522	49
1955	9,670,796	30,509,515	43
1956	7,727,264	28,051,746	56
1957	6,919,724	25,592,130	57
1958	6,440,319	26,335,109	60
1959	5,370,580	25,801,395	62

* Reproduced from Canada Year Book, 1960 — p. 650

** Wildlife pelts for Newfoundland included from 1952

Table 2: Percentage Distribution, Total Value of Pelts (Wild and Ranch-Raised) Produced, By Provinces and Territories, 1954-55 to 1958-59

Prov. or Terr.	1954-55	1955-56	1956-57	1957-58	1958-59
	%	%	%	%	%
NFLD.	0.2	1.0	1.0	1.8	1.6
P.E.I.	0.4	0.2	0.3	0.2	0.2
N.S.	1.8	1.3	2.6	1.7	2.0
N.B.	1.2	1.0	1.1	1.2	0.8
QUE.	9.1	7.5	7.7	7.3	8.9
ONT.	23.7	25.4	21.7	25.4	27.4
MAN.	19.8	21.7	23.4	19.4	18.6
SASK.	14.9	12.3	11.7	12.4	10.0
ALTA.	15.0	13.4	13.2	12.7	12.4
B.C.	9.3	12.7	14.0	14.1	14.5
Y.T.	0.8	0.6	0.4	0.5	0.3
N.W.T.	3.8	2.9	2.9	2.8	3.1
CANADA	100.0	100.0	100.0	100.0	100.0

Table 3. Total Number and Value of Canadian Wild and Ranch Fur Production of Most Important Species 1920–59 – By 10-year Periods

Species Wild	1920 Number	– 1929 Value	– 1930 Number	– 1939 Value	1940 Number	– 1949 Value	1950 Number	– 1959 Value
		$		$		$		$
Bear-Polar	3,279	75,506	1,238	14,589	1,622	36,976	4,417	146,078
Beaver	1,447,490	28,386,081	564,030	6,830,036	1,216,053	37,770,607	2,581,578	34,946,227
Ermine	4,708,531	5,209,266	7,134,121	4,606,420	7,246,173	11,778,397	3,729,563	5,189,449
Fisher	62,134	3,861,927	36,489	1,811,812	33,004	1,662,554	51,747	1,078,380
Fox-Cross & Red	654,364	14,747,506	839,183	10,440,849	1,171,800	11,600,325	177,499	279,005
Fox-White	375,061	14,740,256	520,298	9,486,346	459,192	9,453,026	403,332	4,879,369
Lynx	218,515	5,143,044	133,438	3,533,094	79,575	2,955,835	101,978	799,399
Marten	448,391	11,025,367	234,204	4,341,068	188,065	7,165,843	166,007	1,974,363
Mink	1,401,871	16,058,032	1,544,185	15,181,386	2,682,950	70,354,523	1,305,117	27,297,562
Muskrat	25,277,740	37,803,117	21,917,021	18,289,526	28,838,349	62,637,643	35,000,211	42,077,574
Otter	115,299	3,145,048	98,431	1,844,495	110,041	2,457,995	141,623	3,404,483
Rabbit	2,304,729	221,456	3,109,952	334,363	12,644,595	2,163,128	762,653	356,126
Raccoon	290,089	1,609,958	208,895	871,281	246,414	845,467	287,074	525,114
Squirrel	1,023,959	1,151	10,127,870	1,225,687	29,759,798	11,281,794	20,206,799	9,655,550
Wolf	112,094	1,716,024	82,498	922,809	44,030	480,800	9,211	56,778
Wolverine	12,177	204,223	6,907	42,398	5,344	48,106	5,226	86,717
Chinchilla	–	–	–	–	–	–	* 17,914	256,659
Fox	–	–	** 1,516,595	42,349,211	1,773,197	39,817,106	237,957	2,585,111
Mink	–	–	–	–	–	–	7,329,838	121,387,047

* For 4 year period 1956 – 1959
** For 9 year period 1931 – 1939

Table 4. Principal Statistics of the Fur Dressing Industry, 1954–58.[a]

ITEM	1954	1955	1956	1957	1958
Establishments ..... No.	17	18	16	16	14
Employees on salaries –					
Male ..... No.	84	92	97	102	75
Female ..... No.	19	24	19	18	15
Employees on wages –					
Male ..... No.	859	876	777	782	680
Female ..... No.	180	170	159	157	138
Salaries paid ..... $	437,131	538,703	600,687	748,838	485,254
Wages paid ..... $	2,562,980	2,756,638	2,655,259	2,636,590	2,439,445
Cost of materials used (dyes, chemicals, etc.) $	963,538	1,121,805	1,057,850	1,248,961	895,585
Pelts treated ..... No.	9,279,897	9,762,062	9,119,334	8,960,044	8,305,294
Amount received for treatment of furs ..... $	5,634,991	6,498,292	6,241,696	6,299,336	5,508,408

[a] Reproduced from the Canada Year Book, 1960, p. 655

Table 5. Principal Statistics of the Fur Goods Industry, 1954–58*

ITEM	1954	1955	1956	1957	1958
Establishments ..... No.	581	558	522	540	493
Employees on salaries –					
Male ..... No.	1,083	1,015	995	1,007	891
Female ..... No.	282	257	243	226	227
Employees on wages –					
Male ..... No.	2,435	2,369	2,199	2,214	1,980
Female ..... No.	1,489	1,378	1,214	1,289	1,228
Salaries paid ..... $	4,531,941	4,470,610	4,490,164	4,727,107	4,858,051
Wages paid ..... $	9,816,442	9,652,509	9,675,793	10,307,339	10,074,811
Cost of materials used ..... $	36,058,592	38,389,138	39,044,908	38,988,557	37,667,750
Value of factory shipments ..... $	58,464,790	60,349,381	61,126,085	62,187,649	61,124,191

* Reproduced from Canada Year Book, 1960. p. 656.

References

[1] Anonymous. Furs. *Fortune*, XIII (1): 64-74. 1936.

[2] Anonymous. *Women's Wear Daily*. November 3, 1960.

[3] Balikci, Asen. "Some acculturative trends among the Eastern Canadian Eskimos," in Anthropologica. N.S.II (2): 139-153. 1960.

[4] Bryant, J.E. and H.R. Conn. *An investigation of fur and game management in the Mackenzie District, 1959*. (MS. on file, Northern Administration Branch, Department of Northern Affairs and National Resources).

[5] Chitty, H. "Canadian Arctic wild life enquiry, 1943-49: with a summary of results since 1933", in Journal of Animal Ecology. 19: 180-193. 1950.

[6] Cowan, I. McT. "The fur trade and the fur cycle: 1825-1857", in *British Columbia Historical Quarterly*. 2: 19-30. 1938.

[7] "Rabies as a possible control of Arctic Canidae". in *Journal of Mammology*. 30: 396-8. 1949.

[8] De Vos, A. and S.E. Matel. "The status of the lynx in Canada, 1920-1952", in *Journal of Forestry*. 50: 742-5. 1952.

[9] Dymond, J.R. "Fluctuations in animal populations with special reference to those of Canada", in *Transactions of the Royal Society of Canada*. 41: 1-34. 1947.

[10] Elton, C. Voles, Mice and Lemmings — *Problems* in *Population Dynamics*, Oxford. 1942.

[11] Elton, C. and M. Nicholson. "The ten-year cycle in numbers of the lynx in Canada", in *Journal of Animal Ecology*. 11: 215-44. 1942(a).

[12] "Fluctuations in numbers of the muskrat *(Ondatra zibethica)* in Canada", in *Journal of Animal Ecology*. 11: 96-126. 1942(b).

[13] Errington, P.L. "Predation and vertebrate populations", in *Quarterly Review of Biology*. 21: 144-77. 1946.

[14] Forsland, D.E. "Utilization of Alberta fur resources", in *Transcripts, Land-Forest-Wildlife Conference*. pp. 145-147. 1960.

[15] Fuchs, V.R. *The Economics of the Fur Industry*, Columbia University Press. New York. pp. 168. 1957

[16] Gates, Charles M., Editor. *Five Fur Traders of the Northwest*, University of Minnesota Press. pp. 298. 1933.

[17] Gier, H.T. "Rabies in the wild", in *Journal of Wildlife Management*. 12: 142-53. 1948.

[18] Glover, Richard, Editor. Samuel Hearne. *A Journey from Prince of Wales Fort in Hudson's Bay to the Northern Ocean*. 1769-1770-1771-1772. MacMillan Company, Toronto. pp. 301. 1958.

[19] Hatter, J. et al. "Inventory and evaluation of wildlife resources of British Columbia", in *Transactions of the 9th British Columbia Natural Resources Conference*. pp. 472-513. 1956.

[20] Hewitt, C.G. *The conservation of the Wild Life of Canada*, Scribner, New York. pp. 344. 1921.

[21] Innis, H.A. *The Fur Trade in Canada*, University of Toronto Press, Toronto. pp. 463. 1956.

[22] Jones, J.W. *Fur-Farming in Canada*, Mortimer Co. Ltd. Ottawa. pp. 278. 1914.

[23] Lack, D. *The Natural Regulation of Animal Numbers*, Clarendon Press, Oxford. pp. 343. 1954.

[24] MacKay, Douglas. *The Honourable Company, A History of the Hudson's Bay Company*, Musson, Toronto. pp. 396. 1838.

[25] Murie, A. *The Wolves of Mount McKinley*, Fauna Series 5: 238. U.S. Government Printing Office, Washington. 1944.

[26] Oswalt, Wendel H. and James W. Vanstone. "The future of the Caribou Eskimos", in *Anthropologica*. N.S. II (2): 154-176. 1960.

[27] Parker, S. "Speaking out in furtown," in *Women's Wear Daily*. October 19, 1960.

[28] Reisman, D., N. Glazer, and R. Denney. *The Lonely Crowd*. Doubleday Co., New York. pp. 359. 1950.

[29] Rich, E.E. "Trade habits and economic motivation among the Indians of North America", in *The Canadian Journal of Economics and Political Science*. 26(1): 35-53. 1960.

[30] Ritchie, W.M., J.F. Grant, and G. Hazen. *Canadian furs in markets abroad*, MS. Federal-Provincial Wildlife Conference, Ottawa. pp. 16. 1957.

[31] Schipper, S.S. *The domestic fur market — problems and prospects*, MS. Federal-Provincial Wildlife Conference, Ottawa. pp. 10. 1957.

[32] Siivonen, L. "Structure of short-cycle fluctuation in numbers of mammals and birds in the northern parts of the Northern Hemisphere", in *Papers on Game Research*. I: Helsinki, Finland. 1948. p. 1-166

[33] Trachtenberg, S. *An economic review of the wild fur industry*, MS. Federal-Provincial Wildlife Conference, Ottawa. pp. 6. 1957.

Wildlife as a Recreational Resource in the Atlantic Provinces

Harrison F. Lewis,
Chairman, Nova Scotia Resources Council, West Middle Sable, Shelburne Co., Nova Scotia.

Recreational use of wildlife resources is important in the economy of the Atlantic Provinces. Management of these resources is not, however, making full use of what is known in this field. Scientific research and public relations, especially, are but a fraction of what they should be to obtain maximum benefits from the resources.

These resources and the opportunities for obtaining satisfactions from them can be substantially enlarged by farsighted, up-to-date management. With that stimulation, these resources, and the important benefits which can be derived from them, should be available indefinitely.

Principles for recreational use and management of wildlife resources and suggested improvements on present practices are set forth herein.

How to increase and maintain revenues from the participation of visitors in wildlife sport is an outstanding problem that will increase in importance as Atlantic Province industries based on non-renewable resources inevitably contract.

The principal problem, however, is and will increasingly be how to continue to obtain pioneer satisfactions, healthful and wholesome, from wildlife in a region that is progressively developing away from pioneer conditions.

Wildlife[1] is an important base for outdoor recreation in all parts of Canada. Its value, management, and potential in the Atlantic Provinces is the theme of this paper.

In the past half century, forms of recreation involving land use have developed rapidly on this continent. They have become recognized as an essential part of a well-rounded life and as something to which everyone has a right.

Recreation related directly to wildlife is generally regarded as exceptionally pleasing, beneficial, and wholesome. It includes hunting, angling, observing, photographing, and studying wildlife, as well as mere association with it. Hunting and angling tend to consume their wildlife base; the other forms of wildlife recreation do not.

Some Basic Considerations

Wildlife resources are valued by man because of the satisfactions that they provide. Some of these satisfactions are salable and some are not.

In planning the management and use of wildlife resources, it is necessary to recognize the different kinds of satisfactions that they afford and to assign priorities. Wildlife furnishes recreation to residents of the provinces in which it is found and it may also be made a source of income for those residents through the sale to non-residents of hunting, angling, and other privileges based on it.[2] Which of these types of benefit is to have precedence?

Though revenues derived from wildlife may be measured, benefits and satisfactions that residents of the Atlantic Provinces obtain from their personal harvesting of wildlife for sport, and from their other recreational relations with wildlife, cannot be measured. Such benefits include improved health and alertness and improved acquaintance with and comprehension of the environment in which they live.

We are free to choose whether we prefer satisfactions derived directly from wildlife or satisfactions that we may purchase with funds obtained by selling rights to wildlife exploitation, and related goods and services. It is definitely the view of this paper that satisfactions derived directly from wildlife are much the more valuable and generally preferred and must therefore be given precedence.

There can be no question but that continuation of trends toward increasing income and leisure time will cause tremendous pressure on wildlife resources. Because the Atlantic Provinces have human populations of only moderate density, but are situated close to heavily populated regions, they will experience an accentuated increase in such pressure. To the extent that the satisfying of reasonable wildlife needs of their

own people leaves an available surplus of wildlife benefits, that surplus may be used to meet the wildlife needs of visitors and, in so doing, to augment local revenues.

The values of wildlife must be accorded appropriate and effective recognition. This will at times require adjustments by other interests, such as agriculture and forestry. Mutually helpful co-operation with other resource users must be sought and made effective. All users of public lands should be required to take wildlife and recreational values effectively into account.

Satisfactions derived from wildlife are interwoven with satisfactions of other kinds. Hunting, angling, and other wildlife pursuits are much more enjoyable in a beautiful and satisfying landscape than in drab or despoiled surroundings. Suitable provision for wildlife recreation in an appropriate, attractive environment may make it not only one of the glories of life in the Atlantic Provinces, but also one of the most important aspects of their economy. It would be good policy for the Atlantic Provinces to manage their wildlife so that it will best serve as a component of the resource base of recreation in the region. The benefits received from wildlife should be perpetual.

Special Advantages and Disadvantages of the Atlantic Provinces.

The Atlantic Provinces are blessed with delightful scenery and an equable, temperate climate. The three larger provinces still contain many sparsely settled, unspoiled areas, as well as varied stocks of game. All of the provinces are in a good position to furnish wildlife recreation.

The northeastern part of the United States contains more than fifty million people, among whom there is a rapidly growing interest in hunting and fishing. Ontario and Quebec have a population of more than ten million. A high proportion of these sixty million people have incomes that put them within easy reach of the Atlantic Provinces. These provinces are therefore favorably situated to furnish wildlife recreation to large numbers of visitors, as well as to their own people. As long as an annual surplus of game can be provided, the wildlife recreation thus shared may well include hunting and fishing.

Special advantages in this respect in Newfoundland are the sparseness of the resident population, which increases hunter safety; the wide areas open to the public; the unusual abundance of moose; the only readily accessible ptarmigan hunting in eastern North America; the absence of coarse fish in fresh waters; and the great unexploited potential for salt-water angling.

Nevertheless, Newfoundland's tourist business is still comparatively small. The province's advantages are partially offset by certain disadvantages, chief of which is doubtless the fact that it is the most distant of the Atlantic Provinces from the dense population centers referred to above. For most people, then, it is more expensive to visit.

Nova Scotia has an impressive array of special advantages which could be used in any efforts to attract visitors interested in wildlife. This province is near New England, with which it has good connections. The province has a good road system; it is easy, therefore, not only to enter Nova Scotia, but also to get to its principal wildlife areas. Nova Scotia has a moderate climate, a long, diverse coast line; many lakes and small rivers, well dispersed; and numerous uncrowded beaches. It contains extensive wooded areas, some of which are still relatively primitive. It is a pleasing characteristic of Nova Scotia that its fresh and salt waters are close together, and its settled areas and wilderness areas are well interspersed. The stand of game is substantial enough, so that diversified wildlife sport is conveniently available in all parts of the province and can be enjoyed amidst beautiful surroundings.

Prominent among disadvantages affecting Nova Scotia in relation to this matter is its limited size, with consequent concentration of hunters and anglers.

Prince Edward Island, with due regard to the limited wildlife stocks that it possesses, makes no strong attempt to induce non-residents to participate in wildlife exploitation. It endeavors to furnish recreational opportunities for its own residents. Even in this limited effort, however, this province is hindered by the restricted character of its stock of game.

New Brunswick's situation with respect to wildlife resources is, in general, comparable to that of Nova Scotia. However, it is closer to New England, Quebec, and Ontario and has direct land connection with them. In proportion to its area, it has less coastline than Nova Scotia.

Though game fish resources in the inland waters of the Atlantic Provinces could be improved, the area involved is not readily capable of substantial enlargement. It is therefore a reasonable assumption that these resources will always be limited.

Salt water fish resources, on the other hand, have a much larger area in which to grow and thrive. They have long supported heavy commercial fishing pressure, compared to which any sport fishing pressure to which they may become subject must be slight. In salt water fishing, therefore, lies the greatest potential for increased sport fishing in the Atlantic Provinces. Nova Scotia is in the lead in emphasizing sport fishing in salt water.

Present Wildlife Management in the Atlantic Provinces

In each Atlantic Province the governmental responsibility for management of wildlife resources rests with

a department of government, headed by a cabinet minister.

Such details as are available with respect to provincial revenues and expenditures on wildlife, and sales of licences are given by Munro.[3]

Newfoundland

In Newfoundland, wildlife is managed by the Wildlife Division of the Department of Mines and Resources, under authority of the Wild Life Act[4], an exceptionally effective and well modeled piece of legislation.

The Wildlife Division has been very active in carrying on substantial research projects relating to important game species, including moose, caribou, varying hare, lynx, beaver, and ptarmigan.

The Wildlife Division has also stressed work in the essential field of information and education. An expanded and effective educational program, dealing with both the schools and the general public, is being carried on.

The Division is active in law enforcement by its own officers and in co-operation with the Royal Canadian Mounted Police and Rod and Gun Clubs.

In the formulation of restrictive hunting regulations, reliance is placed chiefly on closed seasons and bag limits. Season limits on moose and caribou are without sex distinction. There is restriction of firearms for hunting big game. The use of aircraft for hunting and fishing is stringently controlled.

Though this province has many large and spectacular nesting colonies of seabirds, they are little utilized as tourist attractions.

Dams constructed in the course of harvesting the forests are an important hindrance to building up the salmon population. Old dams in disrepair are worse than active ones.

Nova Scotia

In Nova Scotia, wildlife is managed by a Director of Conservation in the Department of Lands and Forests, under the authority of Part III, Game, of the Lands and Forests Act[5]. A great deal of detail relating to the management of Nova Scotia game receives the direct attention of the Legislature or a committee thereof.

At present only two qualified wildlife scientists are employed by the Department of Lands and Forests. That Department engages in educational work by means of newspapers, radio, and television and through booths at county exhibitions. Motion pictures on conservation topics are shown in schools and at the meetings of various adult groups. The Wildlife Park at Shubenacadie does much to interest Nova Scotians and visitors in the wild creatures of the province.

Law enforcement is carried on by a staff of some 60 Forest Rangers and nine Fire Rangers and assistants, as well as through the co-operation of the Royal Canadian Mounted Police. All of these officers have other responsibilities and can devote only part-time attention to wildlife protection. There are also seven wardens who patrol four game sanctuaries having a total area of about 500 square miles.

The principal restrictions on the taking of wildlife are closed seasons and bag limits. There are various restrictions on the use of firearms and ammunition, some restrictions on the kinds of places where hunting may be done and minor restriction of the use of aircraft.

The full potential of Nova Scotia's wildlife resources has yet to be developed. The licensing system is distinctly inadequate. Nova Scotia does not issue small game licences or angling licences for residents. As a result, data essential for sound management of wildlife stocks are often lacking. The value of seabird colonies as tourist attractions is little appreciated.

Prince Edward Island

In Prince Edward Island, wildlife resources are under the authority of the Department of Industry and Natural Resources, and of Fisheries. The relevant Statute is the Prince Edward Island Fish and Game Protection Act[6]. This Department has no full-time staff for their protection. For law enforcement it depends on the Royal Canadian Mounted Police. It is probably because of the relatively small size of the population that enforcement of the laws for conservation of game creatures is reliably reported to be much in need of improvement.

The Prince Edward Island Government has undertaken the construction of dams to form trout ponds. Some pheasants have been released, and a pheasant hatchery is being established.

New Brunswick

New Brunswick wildlife is administered by the Fish and Wildlife Branch of the Department of Lands and Mines, under authority of The New Brunswick Game Act[7].

Direct management by legislation adopted by the Legislature is the common practice, though provision is made for the use of Orders in Council and Ministerial Orders, in some circumstances.

The Department has begun to build up a staff of wildlife management scientists, but at present it employs only two.

The public relations work of the Fish and Wildlife Branch is very limited.

An Inspector of Fish and Wildlife devotes his entire time to enforcement of the Game Act, but the Fish and Wildlife Branch does not include enforcement officers. Reliance for enforcement is placed on the field staff of other Branches of the Department and on the Royal

Canadian Mounted Police. These men have other responsibilities also.

The principal management devices are closed seasons and bag limits. Others are limitation of equipment, establishment of game refuges, predator control, and the rearing and release of exotic game. The province maintains 13 game refuges.

The system of ownership of riparian rights interferes, to some extent, with provincial control of stream and lake fishing in New Brunswick.

On unalienated streams New Brunswick leases to private individuals and organizations those parts in which game fish are found. The leases give exclusive rights to angling privileges in the waters to which they apply. Leases for fly-fishing may not run for more than ten years. The mileage so leased is less than ten per cent of the mileage of game fish waters available.

This province also distinguishes certain parts of streams as Crown Reserve Waters and certain other parts as Crown Open Waters. On Crown Reserve Waters fishing is reserved for anglers who pay a daily rod licence fee, and the number of rods permitted per day on stated areas is limited. None but residents may fish in Crown Open Waters.

The leasing of salmon waters improves salmon conservation if the lessees are the right kind of men.

The New Brunswick system of limited leasing and the classification of other waters may approximate a golden mean between the system of leasing many entire river systems, as in the Province of Quebec, and the practice of making all waters open to the public, as in Nova Scotia.

Factors Tending to Reduce the Value of Wildlife as a Recreational Resource in the Atlantic Provinces.
Factors that tend to reduce the value of wildlife as a recreational resource are largely consequences of the development of the region and the pressure of an increasing human population.

Prominent factors in the category under consideration are industrial expansion; hydroelectric developments; pollution of waters; abuse of forest stands; unwise forest management; insufficient control of fire; poor highway construction and maintenance practices; diversion of land to uses incompatible with wildlife, such as thickly peopled areas, airports and roads; inadequate conservation action by governments; and outdated public attitudes.

Technological changes in recent decades have rapidly improved hunting and angling equipment, increased the mobility of sportsmen, and, through road construction and the use of aircraft and outboard motors, provided easy access to areas that were long protected by their remoteness. To offset the effects of these changes on wildlife requires revision of management practices and development of more responsible codes of behavior on the part of sportsmen. Both have lagged.

Newfoundland, however, takes the view that inaccessibility of many of its waters is adverse to their utilization for sport fishing.

Nova Scotia protests the removal of gravel from salmon rivers for construction purposes and the fact that some dams lack fishways while the fishways provided in connection with other dams are inefficient. Expansion of industry, including hydroelectric developments, and the abuse of forest stands have caused difficulties for wildlife management in Nova Scotia.

In Prince Edward Island the sprinkling of roads with calcium chloride is found adverse to game birds, as are also certain agricultural practices.

In New Brunswick, with its vast areas of forest supplying a large pulpwood industry, widespread use of DDT as a forest insecticide has seriously damaged some wildlife resources. DDT distributed by an aerial spray enters forest streams, where it kills many small salmon and great numbers of stream insects that are the natural food of salmon. This situation has caused unprecedented difficulty in managing this valuable game fish. Difficulties also arise from the fact that many roads in the forests are controlled by the private interests that built them, preventing access to abundant game populations.

Suggested Improvements
The improvement of management of wildlife for recreation in the Atlantic Provinces requires more funds and effort and better organization and planning.

In New Brunswick and Nova Scotia, at least, the setting up of a government Department of Conservation and Recreation, administering wildlife, provincial parks, services to the tourist industry, and the provincial interest in commercial fisheries, should concentrate interest in wildlife, its conservation and its legitimate exploitation, and give these matters a more effective voice in the counsels of government.

Government departments charged with responsibility for managing wildlife resources should be provided with adequate appropriations. Ear-marked funds are not in accord with approved Canadian practice, but in making appropriations, regard may properly be had to revenues accruing through the use of the resources involved.

Wildlife is the property of the public. It should be lawful to reduce it to private possession only under a general system of licences that will provide information requisite for managing it and funds for supporting such management.

For true success in the conservation and use of wildlife resources, adequate, organized, modern public relations work is essential. Necessary public understanding and support can be obtained in no other way.

Adequate use of funds and effort in this field will reduce the effort necessary in various other lines of endeavor and put wildlife management on a much sounder footing.

The best possible inventories of existing stocks of game mammals, birds, and fish will be a sound starting point for improved and realistic wildlife management.

Scientific wildlife research, carried on by adequate staffs of well qualified men, is a continuing necessity for sound wildlife management. While it is impracticable to base conservation legislation solely on the results of scientific research, it should not fail to take those results into account. Under existing conditions, a continuing and adequate supply of wildlife will be present only with the aid of deliberate management.

Legislation relating to wildlife should preferably be of the general type of Newfoundland's Wild Life Act, laying down a broad basis for organization and action, but making the details the responsibility of the Minister in charge.

The department or part of a department in charge of wildlife conservation needs a trained field staff, appointed and advanced on a merit basis, and not responsible for discharge of other duties. These men should be specially prepared to enforce the law, engage in local work in public relations, and assist the department's wildlife scientists in research and management work.

Special attention must be given to manipulation of environment to make it more suitable for fish and for terrestrial forms. This manipulation should be based on results of research.

Experiences with uncontrolled fire in the Atlantic provinces in the summer of 1960 have emphasized the fact that improved control of fire is highly important.

In all Atlantic Provinces except Prince Edward Island, there is need for close control of aircraft used in connection with hunting and fishing.

The importance and the role of refuges varies with various kinds of wildlife. Scientific investigation should show when and where refuges are desirable. They may be needed for direct aid in building up wildlife populations or as show-pieces of wildlife conservation, for the enjoyment of the public and to stimulate public interest.

Public interest in wildlife and benefit from wildlife resources in the Atlantic Provinces can be substantially increased by establishment, in each province, of sizable provincial parks, in which a high proportion of the area is maintained as habitat suitable for native wildlife.

The value of provincial and national parks to the public will be greatly enhanced by the provision of adequate interpretative staffs and facilities in conjunction with them. Capable nature guides, nature museums, and nature trails and programs should all have a useful part, adding to public enjoyment and public education with respect to wildlife.

Pollution of waters and large-scale use of pesticides should be closely and firmly controlled in the public interest. The use of new pesticides should not be permitted until all effects of their use are adequately known as a result of scientific research.

Experienced wildlife authorities have shown repeatedly that the payment of bounties is a very inefficient tool for control of wildlife species and results in a serious waste of public funds. Bounties paid by New Brunswick in 1948-49 totaled about $42,000; in 1958-59, about $23,000. In 1959-60, Nova Scotia paid $2,640 in bounties on bears. In some years, Prince Edward Island has paid as much in bounties as on all other aspects of wildlife management; e.g. in 1950-51, $11,000 for bounties out of a total expenditure of $21,000.

Bounties do not concentrate control effort where it is needed; a high proportion of them are paid on animals that would be killed anyway, and when they are high enough to produce effect they stimulate fraud. It is not in the public interest to pay bounties unless thorough investigation has shown special need for them.

The black bear is an important wildlife resource in all Atlantic Provinces except Prince Edward Island. It is in high repute as a game animal and occasionally causes damage to man's interests. When control of black bears is found desirable, it is decidedly in the public interest to bring it about through controlled hunting from which high revenue can be anticipated, rather than by disbursement of funds from the public treasury in the form of bounties.

When management of a given species impinges on other species, no action policy should be established until the values of all species involved and the satisfactions that they are capable of supplying have been carefully assessed and taken into account.

In order to ensure that fish and game bird hatchery products are utilized to the best advantage, they should be released only in places approved as a result of adequate scientific research.

Hunting and fishing on privately owned lands is an important part of hunting and fishing in Nova Scotia, New Brunswick, and Prince Edward Island. Landowners have a right to control or prevent trespass on lands on which they pay the taxes, but appropriate government agencies should actively seek and foster ways of maintaining public hunting and fishing on a high proportion of privately owned lands.

Establishment of properly controlled private hunting and fishing preserves can help to provide sport hunting and fishing in densely populated areas, can extend the seasons for such sports, and can lessen hunting and fishing pressure on other areas. Under present conditions, hunting and fishing preserves, intelligen-

tly managed, are unobjectionable and may have public usefulness.

The Atlantic Provinces have been the scene of several successful introductions of exotics, such as moose in Newfoundland, white-tailed deer in Nova-Scotia, and several species of game fish in various waters. Therefore the public in the Atlantic Provinces naturally desires introduction of additional exotics.

Nevertheless, it is well known that most introductions of this kind fail and that they involve serious risk of damage to established species and to man's interest. No such introductions should be attempted or permitted until adequate scientific investigation has established their desirability and the way in which they should be made.

For the present and the immediate future there are plenty of wildlife resources, but many that could be a source of sport are not generally recognized as such. The need is not so much to multiply the wildlife stocks as to induce the populace to recognize and utilize the resources that are already there and readily available. Wildlife in the Atlantic Provinces that could well be developed and made more popular as a source of sport includes bears, wildcats, raccoons, foxes, herring gulls, great black-backed gulls, starlings, yellow perch, tomcod, saltwater ground fish, and, in Newfoundland, ouananiche, speckled trout, brown trout, and Arctic char.

Inevitable Limitations and Reasonable Prospects

In Newfoundland no serious limitations to recreational use of wildlife resources are anticipated in the near future. Prospects for such use are held to be good and improving. Public education concerning wildlife and its conservation is helpful.

Nova Scotia is far from attaining its potential in recreational use of wildlife. Wildlife resources, correctly valued and wisely managed, are capable of taking a very large part in the economy of the province and the life of its people. As inevitable reduction in Nova Scotia's non-renewable resources takes place and human population grows, wildlife will be found increasingly important.

Prince Edward Island, because of its limited size, its widespread and flourishing agriculture, and its comparatively high population density, cannot anticipate marked expansion of hunting opportunities. In this province big game hunting is practically out of the question. Wild goose and fox hunting could be developed to greater importance. Trout fishing is being developed by formation of suitable ponds. Saltwater angling is capable of marked expansion.

Much of the area of New Brunswick is utilized by the wood pulp and paper industry. The normal operations of that industry involve a rotating pattern of land use that will maintain maximum areas of ideal habitat for moose, deer, and other forest wildlife. A good forest stand will also tend to maintain salmon and trout streams. Prospects for recreational use of wildlife resources in this province are excellent, provided government and people take up a position in the forefront of modern wildlife management.

Notes

[1] In this paper, *wildlife* means wild mammals, birds, and fish that are utilized or utilizable for recreation.

[2] It has been estimated that the value of goods and services provided to hunters and fishermen in Newfoundland in 1958 was $1,986,500. Such estimates are not available from any of the other Atlantic Provinces. It would be useful to have them.

[3] Munro, D.A. *Legislative and Administrative Limitations on Wildlife Management.* Paper prepared for 1961 "Resources for Tomorrow" Conference.

[4] Chapter 197 of the Revised Statutes of Newfoundland, 1952.

[5] Chapter 145 of the Revised Statutes of Nova Scotia, 1954.

[6] Chapter 13 of the Revised Statutes of Prince Edward Island, 1959.

[7] Chapter 95 of the Revised Statutes of New Brunswick, 1952.

Bibliography

Anonymous. *Fishing Facts on Prince Edward Island,* Tourist and Information Branch, Government of Prince Edward Island, Charlottetown.

---------- *National Parks of Canada, Maritime Provinces,* Department of Northern Affairs and National Resources, Ottawa.

---------- *Outdoors New Brunswick,* New Brunswick Travel Bureau, Fredericton.

---------- *Prince Edward Island, Canada. Its Resources and Opportunities,* National Development Bureau, Department of the Interior. Ottawa. 1930.

---------- Atlantic Salmon, Federal-Provincial Co-ordinating Committee. First Annual Report. 1950.

---------- *The Recreational Resources of the United States, National Recreation Association.* New York. 1953.

---------- *Trout and Salmon in Nova Scotia,* Fisheries Division, Department of Trade and Industry, Nova Scotia. 1954.

---------- *Conservation of Wildlife,* The Royal Bank of Canada. About 1955.

---------- "Investigation and Management of the Atlantic Salmon", *Trade News,* Volume 7, no. 10. April 1955. p.p. 3-11.

---------- *National Survey of Fishing and Hunting,* United States Department of the Interior, Fish and Wildlife Service. 1955.

---------- *The Wildlife of Newfoundland,* Report by the Wildlife Management Institute, Washington, D.C. 1955.

---------- *A report on Fish and Wildlife Conservation.* The Conservation Council of Ontario. 1956.

---------- Big Game Fishing, Newfoundland, *Trade News.* Volume 10, no. 5, p. 21. November. 1957.

---------- *Hunting and Fishing Guide to Newfoundland.* Newfoundland Tourist Development Division of the Department of Economic Development. 1958.

---------- *1959 Travel Survey,* Canadian Government Travel Bureau, Ottawa.

---------- "The Future of the Atlantic Salmon." *Trade News,* Volume 11, no. 8, pp. 3-6. February 1959.

Anonymous. *The National Directory of Shooting Preserves, Season 1960-61,* Sportsmen's Service Bureau.

---------- The Problem of Recreational Water Conflicts, SFI Bulletin No. 105. The Sport Fishing Inst., Washington, D. C. August 1960.

Archibald, E.S., and others "The Use and Conservation of Canada's Farm Lands," *Agricultural* Institute Review, Volume 9, No. 2. pp. 11-80. March – April 1954.

Burridge, E.W., "Investigation and Management of Atlantic Salmon in 1957 – The Management Programme," *Trade News,* Volume 10, No. 12, pp. 19-23. June 1958.

---------- "Investigation and Management of Atlantic Salmon in 1958--Part 2. The Management Programme," *Trade News,* Volume 11, No. 11, pp. 11-16, May 1959.

Camp, Dalton K., The Tourist, *The Atlantic Advocate,* Volume 49, no. 11, pp. 41-34. July 1959.

Curtis, Henry S., *Play and Recreation for the Open Country,* Ginn and Co. Boston, New York, Chicago, London. 1914.

Elson, P.F., and C.J. Kerswill, "Studies on Canadian Atlantic Salmon". *Transactions of the 20th North American Wildlife Conference*, Washington, D.C. pp. 415-426. 1955.

Grasberg, Eugene, Economic Benefits of the Atlantic *Salmon to the Province of New Brunswick, Department of Economics and Political Science*, University of New Brunswick, Fredericton. 1956.

Gunn, William W.H., Roderick L. Haig-Brown, Harrison F. Lewis, E.G. Oldham, and W.F. Tisdale, National Wildlife and Recreational Objective and Policies, Papers *presented at the Resources Conference, Ottawa. April 23*, 1954.

Hourston, W.R, "Fisheries Conservation and Development", *Trade News*, Volume 12, no. pp. 3-8. March 1960.

Jones, Anna May, Leisure Time Education, Harper *and London*. 1946.

Kask, J.L., 1956 "Investigation and Management of the Atlantic Salmon. The Changing Environment", *Trade News*. Volume 9, no. 12, pp. 3-4. June 1957.

Kerswill, C.J., "Maritime Salmon Catches since 1949", *Trade News*, Volume 7, no. 6. pp—10. December 1954.

---------- "Investigation and Management of the Atlantic Salmon in 1955, Part 1. The Research Programme", *Trade News*, Volume 8, no. 10. pp. 5-12. April 1956.

---------- "1956 Investigation and Management of the Atlantic Salmon. Part 1. The Research Programme," *Trade News*, Volume 9, no. 12. pp. 5-15. June 1957.

---------- "Regulations of the Atlantic Salmon Fisheries", *The Canadian Fish Culturist*, Issue 22 May, 1958. pp. 7-12.

Kerswill, C.J., "Investigation and Management of Atlantic Salmon in 1959. Part 1. The Research Programme". *Trade News*, Volume 11, no. 11. pp. 3-10. May 1959.

---------- "Investigation and Managment of Atlantic Salmon in 1959-60. Part 1. The Research Programme". Part 11. The Management Programme, *Trade News*, Volume 12, no. 12. June 1960. pp. 3-16.

----------"The Future of the Atlantic Salmon," *Trade News*, Volume 11, no. 8, February 1959. pp. 3-6.

---------- *The National Directory of Shooting Preserves*, Season 1960-61, Sportsmen's Service Bureau.

---------- *The Problem of Recreational Water Conflicts*, SFI Bulletin No. 105. The Sport Fishing Institute, Washington, D.C. August 1960.

Archibald, E.S. and others. "The Use and Conservation of Canada's Farm Lands", *Agricultural Institute Review*, Volume 9, No. 2, March – April 1954. pp. 11-80.

Burridge, E.W. Investigation and Management of Atlantic Salmon in 1957 -- The Management Programme, *Trade News*, Volume 10. No. 12. June 1958. pp. 19-23.

----------"Investigation and Management of Atlantic Salmon in 1958--Part 2. The Management Programme." *Trade News*, Volume 11, No. 11. May 1959. pp. 11-16.

Camp, Dalton K. "The Trourist", *The Atlantic Advocate*, Volume 49, no. 11. July 1959. pp. 41-43.

Curtis, Henry S. *Play and Recreation for the Open Country*, Ginn and Co. Boston. New York, Chicago, London. 1914.

Elson, P.F., and C.J. Kerswill, "Studies on Canadian Atlantic Salmon", *Transactions of the 20th North American Wildlife Conference*, Washington, D.C. 1955. pp. 415-426.

Grasberg, Eugene, *Economic Benefits of the Atlantic Salmon to the Province of New Brunswick*, Department of Economics and Political Science, University of New Brunswick. Fredericton. 1956.

Gunn, William W.H., Roderick L. Haig-Brown, Harrison F. Lewis, E.G. Oldham, and W.F. Tisdale. *National Wildlife and Recreational Objective and Policies*, Papers presented at the Resources Conference, Ottawa. April 23, 1954.

Hourston, W.R. "Fisheries Conservation and Development," *Trade News*, Volume 12, no. 9. March 1960. pp. 3-8.

Jones, Anna May. *Leisure Time Education*, Harper and Bros. New York and London. 1946.

Kask, J.L. "1956 Investigation and Management of the Atlantic Salmon. The Changing Environment", *Trade News*, Volume 9, no. 12. June 1957. pp. 3-4.

Kerswill, C.J. "Maritime Salmon Catches since 1949", *Trade News*, Volume 7, no. 6. December 1954. pp. 3-10.

---------- "Investigation and Management of the Atlantic Salmon in 1955, Part 1. The Research Programme", *Trade News*, Volume 8, no. 10. April 1956. pp. 5-12.

---------- "1956 Investigation and Management of the Atlantic Salmon. Part 1. The Research Programme," *Trade News*, Volume 9, no. 12. June 1957. pp. 5-15.

---------- "Regulation of the Atlantic Salmon Fisheries," *The Canadian Fish Culturist*. May 22, 1958. pp. 7-12.

Kerswill, C.J. "Investigation and Management of Atlantic Salmon in 1958. Part 1. The Research Programme," *Trade News*, Volume 11, no. 11. May 1959. pp. 3-10.

----------"Investigation and Management of Atlantic Salmon in 1959-60. Part 1. The Resarch Programme. Part 11, The Management Programme," *Trade News*, Volume 12, no. 12. June, 1960. pp. 3-16.

Kerswill, C.J. P.F. Elson and M.H.A. Keenleyside. "Investigation and Management of Atlantic Salmon in 1957- The Research Programme," *Trade News*, Volume 10, no. 12. June 1958. pp. 3-18.

Leopold, Aldo, "The Conservation Ethic," *Journal of Forestry*, Volume XXX1, no. 6. October 1933.

---------- "Conservation Economics," *Journal of Forestry*, Volume XXX11, no. 5. May 1934.

---------- "Conservation Esthetic". *Bird-Lore*, Volume XL, no. 2. March-April, 1938. pp. 101-109.

---------- *Game Management*, Charles Scribner's Sons. New York and London. 1948.

Lewis, Harrison F. *Conservation of Natural Resources, Science in Action*,

Book two, Unit Five, J.M. Dent & Sons (Canada) Limited. Toronto and Vancouver. 1959. pp. 461-504.

---------- *Outdoors in Nova Scotia*, Nova Scotia Travel Bureau, Department of Trade and Industry. Halifax. 1960.

Livingstone, D.A., "The Fresh Water Fishes of Nova Scotia." *Proceedings of the Nova Scotian Institute of Science*, Volume XXIII, Pt. 1. 1950-51. pp. 1-90.

Orchard, C.D. "The British Columbia Forest Service in the Field of Recreation in Provincial Parks and Forests," *The Forestry Chronicle*, Volume 29, no. 2. June 1953. pp. 174-180.

Ricker, W.E. "Pacific Salmon for Atlantic Waters," *The Canadian Fish Culturist*, Issue 16. August 1954. pp. 6-14.

Romney, G. Ott. *Off the Job Living*, A.S. Barnes and Co., New York. 1945.

Scott, W.B., and E.J. Crossman. *The Freshwater Fishes of New Brunswick: A Checklist with Distributional Notes*, Contribution of the Royal Ontario Museum, Division of Zoology and Palaeontology, No. 51. Toronto. June 20, 1959.

Slavson, S.R., *Recreation and the Total Personality*, Association Press. New York 1946.

Smith, M.W., "Planting Hatchery Stocks of Speckled Trout in Improves Waters," *The Canadian Fish Culturist*, Issue 16. August 1954. pp. 1-5.

Smith, M.W., "Fertilization and Predator Control to Improve Trout Angling in Natural Lakes," *Journal of the Fisheries Research Board*, Canada, 12 (2). 1955.

---------- "Further Improvement in Trout Angling at Crecy Lake, New Brunswick, with Predator Control Extended to Large Trout," *The Canadian Fish Culturist*. Issue 19, November 1956. pp. 1-4.

Smith, M.W. and J.W. Saunders. "Movements of Brook Trout, *Salvelinus fontinalis* (Mitchill), between and within Fresh and Salt Water," *Journal of the Fisheries Research Board*, Canada, 15 (6). 1958. pp. 1403-1449.

Sprules, W.M. "Investigation and Management of the Atlantic Salmon in 1955. Part 2. The Management Programme," *Trade News*, Volume 8, no. 10. April 1956. pp. 13-16.

---------- "1956 Investigation and Management of the Atlantic Salmon. Part 2. The Management Programme," *Trade News*, Volume 9, no. 12. June 1957. pp. 15-18.

Stevens, Ross O. *Talk about Wildlife for Hunters, Fishermen and Nature Lovers*. 1944.

Vinal, William Gould. *Nature Recreation*. American Humane Education Society. 1954

An Act Relating to Wild Life. Chap. 197. Revised Statutes of Newfoundland. 1952.

Nova Scotia Fishery Regulations, made under the Fisheries Act. 1955.

Resources for the Future. *Annual Report* for the year ending September 30, 1959. Washington, D.C. December 1959.

Fisheries Act, Chap. 87, R.S.N.B. 1960.

Nova Scotia. *The Lands and Forest Act*, Chap. 145, R.S.N.S., Pt. 111, Game 1954.

The New Brunswick Game Act. Chap. 95, R.S.N.B., 1952.

British Columbia Department of Recreation and Conservation. *Annual Reports*.

Canada Year Book. Annual. Queen's Printer, Ottawa.

Canadian Almanac and Directory. Annual publication by the Copp Clark Publishing Co., Limited. Vancouver, Toronto, Montreal.

Department of Fisheries of Canada. *Annual Reports*.

New Brunswick Department of Lands and Mines. *Annual Reports*.

Newfoundland Department of Mines and Resources. *Annual Reports*.

Nova Scotia Department of Lands and Forests. *Annual Reports*.

93452—57

Legislative and Administrative Limitations on Wildlife Management

David A. Munro,
Chief Ornithologist,
Canadian Wildlife Service,
Ottawa.
(Research Coordinator—Wildlife & Fisheries, "Resources for Tomorrow" Conference)

Legislation and administration form the institutional basis for wildlife management. Where their imperfections reflect faulty public concepts we must rely on positive leadership, using continuous education to improve the process of public decision.

Public ownership, mobility, and non-commercial use give wildlife management its special characteristics. Criteria for judging the effectiveness of management are not clear-cut.

Jurisdiction over the various groups of wildlife is not clearly stated in the Canadian constitution and is characterized by divided responsibility and ad hoc arrangements. This is particularly so with respect to sport fish and migratory birds.

In many provinces the game Acts do not provide the flexibility required for most effective management. If changing biological conditions require, it should be possible to change regulations, by swift executive action.

The game Acts and the Migratory Birds Convention Act are largely concerned with controlling the harvest of the resource. While the reservation and acquisition of lands for wildlife habitat do not seem to be prevented by present legislation, there is a clear need for specific statutory provision for those purposes.

There is need for research on the effects of restriction on hunting and fishing so that we may evaluate regulations, dispense with those which are not effective, and strengthen those which are.

Problems of access to hunting and fishing grounds are becoming more acute. The legal framework for solution of conflict between sportsmen and landowners is generally adequate, but an enduring solution depends on continuous education and the widespread acceptance of a sportsman's ethic.

Suitable areas for public hunting and fishing are urgently required in some regions and their acquisition would be facilitated by specific statutory provision.

The issuance of licences is a fund-raising device and a means of obtaining information on the harvest of fish and wildlife. Several provinces allow a significant amount of hunting or fishing without requiring a licence, thereby foregoing those benefits. In some provinces there is a confusing multiplicity of licenses.

It is considered that apparent conflicts between traditional Indian rights and the need for regulation of hunting and fishing can be resolved.

Defects in the Migratory Birds Convention Act stem from the terminology of the Migratory Birds Treaty. They should be corrected as soon as possible.

The Game Export Act does not provide needed control over interprovincial shipment of live animals.

Game administrations are organized on a line or staff basis. The unique nature of field work required by fish and game agencies calls for specialist field staff, which may be most effectively administered by a line organization. The increasing importance of recreation and wildlife makes it desirable that those interests be directly represented in Cabinets. However, there is a need for close association between fish and game administration and the administration of other renewable resources, and that association must be reflected in operations. Perhaps this can best be affected by means of bodies responsible to Cabinets for advising on resource-use policy and arbitrating inter-resource conflicts.

93452—57½

Public acceptance and effective enforcement of fish and game regulations depends on a specialist staff, well-trained and paid at an adequate level.

The cost of fish and game administration in Canada in 1959 was about $10 million. Revenue directly derived from the resource was in excess of $11.5 million. A larger number of professional personnel is needed by most administrations.

A more exhaustive review of fish and wildlife legislation and administration, oriented particularly toward the development of criteria for assessing their effectiveness, is urgently needed.

Introduction

Several characteristics of wildlife render its management unique among the renewable resources. It is a mobile resource and, as such, poses special problems in management. Harvesting the wildlife crop is, except for some people in remote areas, a form of recreation. The use of wildlife is, to a great extent, non-commercial and this too has given its management a character different from most other resources.

The aim of wildlife management, stated in its simplest terms, is to maintain populations of animals at levels such that they and man may live in harmony and provide a crop which man may harvest.

The principal techniques of management are regulation of the harvest and maintenance or modification of habitat. Because wildlife resources are common property, techniques of management require sanction by law and administration by government if they are to be effectively employed.

It is this legislation and administration which form the institutional basis for wildlife management. There is no established objective formula for assessing its effectiveness in facilitating management, but rough criteria for judgment may be based on trends in wildlive populations, average success in hunting and fishing, costs of management, effectiveness of enforcement, etc. A major difficulty in judgment is in giving proper weight to environmental factors which act on wildlife populations, which vary greatly from region to region, and may or may not be susceptible to human control. For the time being, then, our judgment, though not entirely subjective, cannot be completely supported by quantitive data.

Fish and game agencies, like any other public services, should operate as efficiently as possible. General operating efficiency is not the topic of this review, and only one point need be made here. The conditions of the environment, including human conditions, are constantly changing, and thus fish and game regulations and administrative procedures must continually be altered and refined. It is necessary to keep up with change not only by creating new regulations and procedures, but also by eliminating those which no longer serve any useful purpose. Proper resource management and public satisfaction are both thereby benefited.

Imperfections in the legislative framework and administrative mechanism are not the basic source of weaknesses in wildlife management. The law grows from public concepts, which are the sum of individual concepts; and administration, similarly, proceeds in accordance with public desire. There is, however, often a serious lapse of time between the crystallization of new concepts in the public mind and their reflection in the statutes. Administration too is a conservative institution more often than not. To reduce the lag between public decision and official action, indeed, to speed the process of public decision is the highly necessary function of positive leadership aided by effective information-education programs (1).

In considering legislation affecting wildlife management we must take into account not only the statutes and regulations which deal directly with wildlife, but also the law with respect to lands, forests, and waters, because the use of those resources is intimately associated with the welfare of wildlife. It is necessary also to make some reference to laws regarding property and trespass, because they may affect the conditions under which man may harvest the wildlife crop. Finally, the laws regarding wildlife must be examined to see if they seriously impinge on individual rights and liberties.

Jurisdiction

Jurisdiction over the various groups of wildlife is not clearly stated in the Canadian constitution and is characterized by divided responsibilities based on interpretation, and *ad hoc* arrangements arising from sometime convenience.

The British North America Act (Sec. 91 (12)) assigns responsibility for sea coast and inland fisheries to the Parliament of Canada, but does not otherwise mention wildlife (2). Despite the position of fisheries, it has been broadly interpreted that the responsibility for administration of natural resources is provincial, and thus each province and territory, presuma-

bly interpreting its authority from Sec. 92 (16), has legislation dealing with wildlife. The concept that game regulation is of local interest only is based on a statute of 1856, which was passed by the legislature to have effect only in Upper Canada.

Although fisheries is an area for exclusive federal legislation, many aspects of the administration of the recreational fishery have been delegated to the provinces. Except in the Atlantic Provinces, the National Parks, and the tidal waters of British Columbia, research, management, and law enforcement with respect to fish which are taken primarily for recreation are provincial activities. Provincial officials draft the regulations governing the sport fishery and pass them to the federal Department of Fisheries for the initiation of legislative and executive action. Some officials consider this arrangement to be cumbersome and recommend a review of the relevant administrative facilities.

The management of migratory birds is another area of divided responsibility. In 1916, migratory birds ceased to be considered as of a merely local or private concern in the provinces and became the subject of a treaty with the United States. A federal enabling act, The Migratory Birds Convention Act, 1917, provided that the federal government should have primary regulatory power with respect to migratory birds. The property right in migratory birds remained vested in the provinces, which thereby also retained some measure of responsibility for management.

Legislation

In all provinces except Nova Scotia there are specific legislative instruments for the control and direction of all matters relating to game. In Nova Scotia, a separate part of the Lands and Forests Act deals with game. (See Appendix 1 for a listing of the game Acts).

Several of the game Acts seek to reinforce their authority by the inclusion of a section to the effect that the property in all animals and birds within the province that are wild by nature and while in a state of nature is vested in the Crown in the right of the Province, and that no person shall acquire any right or property therein except in accordance with the Act. In other provinces the claim of the Crown in the right of the Province to the property in game is considered to arise from common law.

In the so-called game Acts there is variation in the *locus of control* and the extent to which control is defined. In some Acts (e.g. Alberta) there are specific, consolidated outlines of the powers vested in the Governor-in-Council, the Minister, and the Game Director; in other Acts, the pattern of delegation of authority must be construed from study of the entire Act.

In Nova Scotia and Quebec the Acts themselves contain specific provisions respecting hunting seasons and bag limits. These, of course, cannot be changed except by legislative amendments, so it is apparent that in those provinces the legislatures reserved considerable authority to themselves. On the other hand, the Newfoundland Wildlife Act contains practically no active clauses, merely providing for action on the part of the Minister, in some cases with, in others without the consent of the Governor-in-Council.

It is clear that Acts like the Newfoundland Wildlife Act provide for the greatest flexibility of action. Biological considerations can be more readily reflected in law by executive rather than legislative action. In the dynamic field of wildlife management, flexibility is of considerable importance.

The game Acts are concerned almost exclusively with controlling the harvest of the resource. Reflecting the state of understanding which prevailed when they were first written, the game laws appear to sanction only such management as is achieved by restriction. In fact on reading the provincial game Acts the thought occurs that they were written as though game were a resource of fixed dimensions unrelated to the environment, needing protection rather than management. Reference to the many statutes dealing with lands and waters does little to dispel that conclusion. There is a clear need for statutory recognition of the place of land management in wildlife management.

Controls over the public harvest exist for three purposes: to prevent undue exploitation of the resource; to facilitate equal opportunity to hunt or fish, while taking certain private rights into account; and to provide for the safety of the public.

A host of provisions and regulations limit the amount of game which any individual may take, and restrict the period during which game can be taken. In most Acts there is a section which provides that no person shall hunt, shoot at, take, wound, or kill any game except at such times and places and in such numbers as may be specified by regulation. This section is followed by regulations, often amended annually because of biological necessity, which effect those sections in specific terms.

Also with the intention of limiting the kill of game, all provinces except Prince Edward Island have provision for the establishment of sanctuaries, i.e., areas where hunting is prohibited. In some provinces the establishment of a sanctuary results in complete pro-

hibition of hunting; in others some measure of controlled or limited hunting is implied or stated. If game is to be managed in accordance with modern concepts, flexibility of control is necessary, and sanctuary regulations should provide for allowing hunting to the extent that local conditions warrant.

Restriction and prohibition of the use of various weapons, tackle, and other tools of hunting and fishing exist primarily in order to reduce the potential kill, or the loss of game by crippling, although restrictions on the use of firearms in vehicles, and the prohibition of shooting during the night may also be justified on the grounds of public safety. Among the outlawed items are large calibre guns, set or spring guns, silencers, tracer bullets, night lights, and a multitude of others. There is little variation from province to province in this respect.

There has been limited use of regulations to reserve special areas or periods of time for the use of special skills such as fly fishing and bow hunting.

Little information is available on the effectiveness of the many methods of limiting the kill of game. We have, for example, no precise measure of the extent to which the kill of ducks is reduced in Ontario by a reduction of the daily bag limit from eight to six. Nor if we knew that, could we confidently say that the same change in regulations would have a similar effect in, say, Nova Scotia. We do not know whether the regulation that prohibits the hunting of migratory birds with a weapon containing more than three shells does in fact result in a smaller total kill than would occur if hunters were allowed to put five shells in their pump guns. Although the effectiveness of the various sorts of sport fishing regulations is better understood, there is a general need for information which will enable an evaluation of our regulations so that we might dispense with those which are not effective and strengthen those which are. Basic to this endeavour is the establishment of surveys to yield precise information on harvest.

Extensive parts of the provincial game Acts deal with the *opportunity to hunt and fish* and the relationship between hunting and fishing rights and those of private property owners. Canada shares the North American tradition of "free hunting and fishing", based on the concept of the Crown (public) title to game. It has been widely held that within the limits imposed by physical and biological factors every Canadian has an equal right to hunt. (The situation in Quebec is not typical and is dealt with further below). But throughout much of Canada this public right would be a hollow one indeed if it were not possible to enter on private lands for the purpose of hunting. In view of the traditional privacy of individually owned lands, the possibilities of conflict of interest are obvious and manifold.

Most of the game Acts are in harmony with the concept that entry into private property without the consent of the owner constitutes trespass. Several state that nothing in the game Act shall limit the remedy at common law of an owner for trespass. In practice there is little legal action taken to prevent trespass except on the complaint of the landowner. The structure of several Acts implies that consent is understood unless the lands are posted, and some acts define what constitutes proper posting. In Ontario, where the pressure of hunters on private lands is undoubtedly greater than elsewhere in Canada, conservation officers are by statute relieved of the responsibility for prosecuting persons suspected of trespass.

The Alberta Game Act contains clauses which severely limit the landowner's rights on his own property. As in most other provinces, the owner's consent is required for entry onto private lands, and consent may be given individually, or generally by a "Hunting Allowed" poster. However, should an Alberta landowner prohibit the hunting of others by posting "No Hunting Allowed", the law prohibits him from hunting on those lands himself. It further provides that anyone may enter private lands, with or without permission, in pursuit of wounded game (3).

The more intense problem in areas of dense human populations has been met in Ontario by provision for township licences. The Ontario Game and Fisheries Act provides that any township may be authorized to issue hunting licences, the number of which may be limited. The number of licences valid in a given area has been limited by other provinces where special management areas have been opened to hunting. In Prince Edward Island there is a statutory limitation on the number of non-resident licences which may be issued. We may expect that action of this sort, to bring the number of hunters into balance with the land available for hunting, may become more prevalent.

The law can provide only the framework for a solution of conflicts between sportsmen and landowners. The basis for enduring good relations is mutual respect arising from a better understanding of each other's problems and that can be achieved only by continuous education. The establishment of information programs with that objective is a responsibility of game administrators which has not been fully met. Universal acceptance of a sportsman's ethic is no

doubt unattainable, but we can go much farther toward it than we have so far.

Where demand and supply are of different orders, it is usually the market which serves to relate them. In most North American hunting and fishing there is no market in the conventional sense. In Saskatchewan and Alberta the sale of hunting rights is prohibited by statute. In the other provinces there is no statutory reference to the sale of hunting rights, and the propriety of prohibiting the sale of hunting rights has been questioned. Certainly there can be no question that an owner has the right to control access to his lands, and that right can be used indirectly but legally to control hunting. Quebec goes the furthest in the other direction: sale or lease of hunting rights by private owners is common practice, and, in addition, by order-in-council, the government may establish hunting territories on public lands remote from settlement and these may be leased to individuals or groups for periods up to ten years. These leases carry with them the exclusive right to hunt on such lands and to prosecute an offender against any provision of the game law. While this provision limits the public right to hunt, it may, by conveying exclusive hunting rights, stimulate better management of fish and game habitat. Similar provisions exist for the management and utilization of Atlantic salmon stocks in Quebec, and also in New Brunswick.

The pressure of the sportsman on the land and the desire of the private landowner to obtain some compensation for all uses of the land have been integrated in another way in recent times by the establishment of private shooting preserves. On shooting preserves stocks of game (usually pheasants or mallards) are raised by the owner and released on his land for shooting by clients who pay a stipulated fee for the privilege. The laws with respect to this sort of operation vary from province to province. In addition the Criminal Code (Sec. 387(1) (f)) prohibits the release of captive birds for the purpose of being shot when they are liberated. In operations of this type it is therefore necessary that the game be released a considerable time before it is hunted. Furthermore, the Migratory Bird Regulations (which apply to all ducks, among other species) prohibit the shooting of birds raised in captivity. Thus, the "tower shoot" of ducks, becoming quite common in the United States, would be in contravention of both the Criminal Code and the Migratory Bird Regulations. The other game species which has become the mainstay of private shooting preserves in the United States is the pheasant. In Ontario and Nova Scotia there is statutory provision for the operation of pheasant shooting preserves. In the other provinces the legal situation is ambiguous at best. Many administrations are opposed to the establishment of such enterprises, perhaps for fear that the sporting quality of hunting will be thereby diminished.

Having discussed the matter of hunters' access to private lands, it is useful to examine the laws of the provinces as they relate to the *provision of public lands for hunting and for the production of game*. In general, the right of access for hunting or fishing to unencumbered Crown lands is implied or stated. This question is of little importance in the unsettled areas of Canada, but it becomes particularly significant in areas where there is conflict regarding land use. The game resource cannot be utilized by the public if the public cannot find a place to hunt, and certain groups of game species, notably the waterfowl, cannot exist if their habitat ceases to exist (4). In all provinces there is statutory provision for the Crown to acquire lands, but in no province is there specific reference to acquisition of lands for the purpose of wildlife management. In Manitoba, lands have been both reserved and acquired for the express purpose of providing waterfowl shooting grounds and reserving waterfowl habitat, but, peculiarly, the lands so acquired are not under the direct administration of the Game Branch. In Nova Scotia, there is provision for the reservation of Crown Lands and the reconveyance to the Crown of alienated lands for the "benefit of the Province", but there is no specific reference to game management purposes. To generalize, it would seem that there is no legal impediment to reservation or acquisition of lands for game management, but needed programs of land reservation and acquisition would be greatly facilitated by specific statutory provision, as often exists with respect to lands being reserved or acquired for other public purposes.

Each game Act or schedule of regulations contains a number of prohibitions which are intended primarily to ensure the *safety of life and property*, both of hunters and the general public. Some of these provisions also tend to limit the kill of game. Among the sorts of things generally prohibited are the carrying of loaded firearms in vehicles, aircraft, and power-boats, and the discharge of firearms during darkness. Some provinces prohibit the discharge of firearms across public thoroughfares. The use of poison for the destruction of predatory animals is closely controlled in all provinces—in striking contrast to the lack of control over the use of poisonous insecticides(5). Only two provinces make it an offence to carry firearms whilst

intoxicated—difficulties of interpretation have perhaps prevented wider adoption of this sort of regulation. Several provinces make it mandatory for big game hunters to wear specially visible clothing as defined by regulation. There appears to be some difference of opinion with respect to the utility of such a regulation. It is not to be expected that regulations with respect to safety would be uniform across the nation, since the conditions of hunting vary widely. It is to be expected that Game Departments should examine their safety record and keep their regulations up to date.

Another relationship between game and private property arises when *game species cause damage* to someone's property, usually a forest or agricultural crop. All the game Acts and the Migratory Birds Convention Act provide that a property owner may take action to protect his property. The degree of freedom allowed in doing so varies somewhat from province to province and may also depend on the species causing the damage. The specific provisions seem to reflect the value placed upon the animal causing the damage. Thus in many provinces it is unlawful for an individual to do anything about beaver causing damage. In view of the present general abundance of beaver this seems somewhat of an anomaly. When deer and other big game animals cause damage they may generally be taken with less freedom than birds and small game animals. No province admits to any liability for damage caused by game, although some, through their warden staffs, provide aid to individuals suffering damage.

The *basis of issuing licences* is rooted in ancient tradition. Since the Crown in the first instance holds all rights to wild animals, it follows that the Crown may establish the conditions under which its subjects may take game and fish. In large part, subject to the various restrictions with respect to time, place, and number, which have already been discussed, the issuance of a licence is a prime consideration. Historically, licences derive from grants or charters issued by the Crown as a matter of privilege under much more stringent conditions some centuries ago. Licences are now mainly a device for raising funds, although it may be remarked that the possibilities in this connection have been barely scratched.

All provinces issue several different classes of licences, the major classifications having reference to the residence status of the applicant and the type of game or fish covered by the licence. Thus licences also serve the function of providing information on the numbers of hunters seeking different classes of game and fish.

In a number of cases, however, the privilege of taking fish and wildlife is extended without the requirement of a licence. Only Newfoundland, New Brunswick, and Quebec require that all hunters and sport fishermen must have a licence no matter where they seek their quarry. In Nova Scotia any resident may hunt small game (other than pheasants) without a licence; and in Prince Edward Island, farmers, farm labourers, commercial fishermen, and their wives may do likewise. Manitoba also extends a special privilege to farmers: a person whose chief occupation is farming may hunt without a licence anywhere in the province. In the remaining provinces, farmers are permitted to hunt small game without a licence only on their own lands (except that in British Columbia a free licence is issued). In Ontario, any resident may fish without a licence. In Nova Scotia any person may fish without a licence.

In those provinces where substantial numbers of persons are allowed to hunt or fish without a licence, an important source of revenue is unexploited, and, in addition, there is no convenient mechanism for estimating the number of hunters or anglers or measuring the size of the harvest.

The variation in types of licences issued arises from the desire to charge varying fees for hunting or fishing for different species or groups of species and to establish a cost differential in favor of residents of the province concerned. The number of types of licences issued in any province varies from four in Prince Edward Island to 15 in Ontario. In British Columbia there are 12 types of licences issued and, in addition, non-residents are required to pay trophy fees on all big game killed. The fees vary according to the species and where the trophy is taken.

While some variation in licensing provisions is certainly desirable, it seems obvious that a multiplicity of licences results in administrative difficulties, and, beyond a certain point, tends to confuse the public. The state of Alaska issues eight different licences, differentiating between residents, non-residents, American citizens, and aliens, and providing a scale of fees in accordance with whether trapping, hunting and fishing are allowed in combination or separately. The Alaskan schedule of licences is much easier to understand than most of the Canadian ones.

A simplified and effective system of licences might be devised, based on four major categories (resident, non-resident, fishing, and hunting) modified by requirements for the payment of trophy fees. Payment of trophy fees could be arranged by the sale of tags, returnable if not used. It should be possible to adminis-

ter such a system so that it would yield about the same revenue as is presently derived, but would do so in a way that would be more satisfactory to the public.

Data on the sale of hunting and angling licences in all provinces in representative years are given in Appendix 2. Most of the figures were taken from departmental reports. Complex classifications of licence sales have been simplified in presentation. Precision of the data is further limited because it was not always possible to account for the issuance of combination licences. In some instances, the required data were not presented in departmental reports. Despite these limitations, broad relationships are apparent between the various categories of licences, as is the spectacular increase between 1939 and 1959 in numbers of licences issued.

As might be expected in a country of which parts are still in the pioneering stage, there are some *special provisions for persons living or traveling by necessity in remote areas to take game for food in cases of emergency*. Understandably, none of the Atlantic Provinces makes such provision. Neither does Ontario, and in Quebec the provision is worded so that the privilege is rarely extended. Apparently the practice is becoming less frequent in the western provinces as well. In the Northwest Territories, holders of general hunting licences (restricted to natives and others who have lived in the Territories since 1938) may hunt pretty well without restriction. Any person in the Northwest Territories may hunt in order to save himself or his family from starvation.

The hunting rights of the Indians in the provinces, particularly in Manitoba, Alberta, and Saskatchewan, where the issue was complicated by the effect of the Natural Resources Transfer Acts, have been the subject of a great deal of controversy. The arguments have been set forth in some detail by Conn (6) from the viewpoint of Indian rights, and by Lewis (7) with respect to wildlife management. There is space here only to summarize the situation.

Those who believe that the rights of Indians, as implied or expressed in the various Indian Treaties, are paramount, claim that the Indians have a right, unlimited except by federal law, to hunt and fish on all but privately owned lands. Since the laws with respect to most game are provincial, it will be recognized that this view implies considerable freedom from regulation. Game administrators, working toward effective management and equitable enforcement, claim that the privileged status of Indians reduces management control over game populations, sometimes to the point where remedial measures are relatively ineffective. The problem is most acute in areas where Indians are in relatively close contact with other hunters, and some Indians become involved in selling game or covering up the violations of other hunters. Some game administrators claim that the Indian rights will be without substance if proper management cannot be effectively applied, and that therefore it is in the interests of the Indians themselves to accept such regulation of harvest as is deemed necessary.

The most unfortunate aspect of this situation is that the long history of controversy, the frequent prevalence of argument unsupported by sufficient fact, and the intrusion of emotional abstractions have obscured the existence of real ground for agreement in principle. It is safe to say that the prior claim of Indians to game and fish in areas where they live in traditional fashion is not at issue. Nor would anyone deny an Indian the right to take game or fish for food when he needs it. On the other hand, the need for control of the harvest of game and fish, even if not always exercised, is beyond question at the present stage of Canadian development. From these two premises, it would seem, a satisfactory scheme of administration can be derived.

The Migratory Birds Convention Act, and Regulations, already referred to, is the principal federal game statute. Passed to enable the administration of the Migratory Bird Treaty with the United States, it contains provisions essentially of the same sort as those contained in the provincial game Acts. The main body of regulations provides for limitation of the number of birds which may be killed, by establishing close seasons, bag and possession limits, and sanctuaries. The taking of migratory birds for scientific purposes, for progagation, and for the protection of crops and other interests is controlled. Restrictions on the means and methods of hunting are established partly as protective devices and to facilitate enforcement of the regulations, and partly in an attempt to equalize hunting opportunity. The Regulations contain an anti-pollution clause.

Some of the defects in the Migratory Birds Convention Act and Regulations stem from the terminology of the Migratory Birds Treaty. It is questionable whether obvious faults in the wording of the Treaty, faults which run counter to its general intent, should be considered to bind the enabling Act. The definitions of migratory birds contain defects of this sort, which should be corrected. Other difficulties arising from the Treaty reflect the incomplete body of information available to those who drafted the Treaty. We know now that it should be possible to allow the harvest

of a number of species of birds which are now protected. Some species of gulls are obvious examples. The prohibition of open seasons prior to the first of September limits the effectiveness of harvest in the far North. In such instances the only recourse is amendment of the Treaty. There has been much opposition to opening the Treaty for amendment, largely arising from fear that to do so would open the way for loss of those aspects of it which are good. Nevertheless, the need for amendment is such that it is desirable to continue to explore the possibilities for alteration.

As with the provincial game statutes, there seems to be no legal impediment to acquisition of lands by the federal government for migratory bird management, but the precedent is yet to be established. This sort of activity urgently requires study.

The Game Export Act provides that interprovincial shipments of game shall be the subject of an export permit issued by the province where the shipment originates. The Act is in force only in those provinces which have requested that it be so proclaimed. All provinces and territories except Prince Edward Island have done so.

A defect in the Game Export Act is that it does not apply to live game. As a consequence there is no control over the interprovincial shipment of live animals. The control needed is with respect to import (to prevent undesirable introductions, spread of disease, etc.); and since practical control must be exerted at the point of shipment, the provinces singly do not have that protection. It is contended that federal legislation to cover this point might be technically *ultra vires*. A real need, which has been repeatedly expressed by provincial officials, nevertheless exists, and the means of meeting it should be thoroughly explored.

Organization.

In considering the administration of wildlife we are concerned with a number of topics. One of the most important relates to the sorts of organizations which are employed by fish and game agencies, and the variations in their relationships with the other parts of the government they serve.

In those provinces which have well-developed fish and game agencies there are two principal types of organization. One type is characterized by a line organization controlled by a central office charged only with fish and game administration. Field officers do fish and game work only. There may be a regional breakdown within such an organization. This sort is typified by the British Columbia Game Branch. The other type of organization is distinguished by the fact that field officers perform a variety of functions related to resources, of which fish and game is only one, and the senior game officials serve in effect as staff officers at the central office. The organizations in Ontario and Saskatchewan are of this sort. In Ontario, the Department of Lands and Forests, which administers fish and wildlife, is radically decentralized. District Foresters, responsible for all functions of the Department within their districts, supervise the activities of fish and wildlife specialists in the districts. As in Saskatchewan, the senior game officials perform a staff function at the central offices.

Objective evaluation of the relative merits of the two types of organizations is difficult, perhaps because, as in all fields of administration, the ability of personnel is of such great importance. However, it is possible to state some of the advantages and disadvantages of the two systems.

The sort of field work which a game agency must carry out—enforcement of game laws, extension work with trappers, making censuses of fish and wildlife, are but a few examples—certainly calls for specialists, persons suited by aptitude and training to their work. It is also true that if field work in the fish and game field is to be carried on effectively it should be able to compete effectively with the administrative demands of other resources for man-power and equipment. These would seem to be good arguments for a line organization providing for full-time, trained fish and wildlife officers at the field level.

On the other hand, it is equally obvious that there are benefits to be derived from close association between fish and wildlife administration and the administration of other renewable resources, particularly at the regional and central office level. Such association will not be of much benefit unless the various resources are represented by officials of equivalent status. Some provinces have organizations which provide for this in part. While provision for integration of administration of all renewable resources is desirable up to a point, it should not extend to the point where senior game officials, specialists in the problems of game administration, are hampered in the exercise of effective supervision over fish and game field staff.

In all provinces except British Columbia and Quebec, sport fish and wildlife agencies are in multi-resource departments associated with forests, usually with commercial fisheries, parks, and crown lands, and sometimes also with mines and waters. It is noteworthy that in no province is fish and wildlife admini-

stration closely associated with agriculture. This lack of liaison is a serious matter in some areas, the more so where agriculture is a dominant occupation.

Quebec has for a long time had a Department of Game and Fish. British Columbia recently created the Department of Recreation and Conservation of which the Game Branch is a major division. Before 1957 game administration in British Columbia was a responsibility of the Attorney-General's Department, a result of the assignment of game enforcement to the provincial police force many years ago.

As with the two sorts of branch organizations the different sorts of departmental associations present both advantages and disadvantages. The usefulness of close association between administration of all the renewable resources has been mentioned. The principal benefit is that a ready mechanism is available for communication of data on basic resources and development proposals, and for planning. The primary disadvantage of multi-resource departments, from the fish and game viewpoint, is that some appear to be dominated by such other of the resources as may be of predominant importance from the economic point of view, and, as a result, the interests of wildlife and recreation are not presented with sufficient force at the policy making level. Again, it is difficult to escape the conclusion that the quality of personnel, in this instance the qualities of judgment and leadership, complicates the assessment of institutional arrangements.

The advantage of having a department responsible for wildlife, or wildlife and recreation alone, lies primarily in providing for representation of that interest in Cabinets. The increasing importance of recreation to all Canadians will make this of more importance in the future. It is likely also that a unitary department can secure better working conditions for specialist staff.

The question of how fish and game administration should be organized thus leads squarely to a dilemma: a line organization of specialist employees responsible to a Minister has many advantages, yet there is obviously a requirement for close coordination with all other aspects of land and water use.

Both organization and departmental association should facilitate the processes of planning, data communication, and evaluation, which are the necessary forerunners of decision in resource development. In provinces where those processes seem to take place effectively now, the cause seems to be more the establishment of satisfactory personal relationships between administrators of different branches than the existence of formally established and obligatory channels of communication and criteria for judgment. Good personal relationships are invaluable, but they cannot be the sole basis for long term resource development.

Resolution of the dilemma may lie in providing for better inter resource co-ordination by means of bodies responsible to Cabinets and charged with advising on resource-use policy and arbitrating inter resource conflicts (8).

If co-ordination of resource uses is difficult at the provincial level, it is even more complicated for the Canadian Wildlife Service, which is responsible for research on and management of migratory birds throughout Canada. The Canadian Wildlife Service is part of the federal Department of Northern Affairs and National Resources. Its relations with provincial game agencies are generally favorable. Annual conferences help to keep them that way. But there is no means for close co-ordination with other resource agencies in the provinces. The means for better co-ordination must be found so long as maintenance of migratory bird habitat remains dependent largely on provincial policies, as it is now.

Enforcement

The usefulness of fish and game regulations is directly related to the extent to which they are accepted and enforced. There are areas in Canada where the public is opposed to fish and game regulations, and the enforcement effort is weak. In such areas a program of public education is probably the prime requirement.

The importance of a well trained specialist enforcement staff cannot be overemphasized. At one stage in the history of game administration in Canada it was common practice to employ untrained, poorly educated persons as game wardens. Such employees often served on a part-time basis; they were usually poorly paid; and their appointments were considered a reward for political services. Obviously, they could not properly fulfil their functions. In the unlikely event that they were competent to do so, the precariousness of their tenure and their status in the community was such that it was rarely in their interest to undertake an active enforcement program. Happily, the trend in Canada is toward the elimination of political appointments in the executive phase of government. In those administrations where vestiges of this sort of system remain, every effort should be made to eliminate them.

The work of a game warden is unique. It is police work in a sense, but police work with a difference—primarily in that the environment in which it is usual-

ly carried on calls for special attributes and capabilities, and also in that the discovery of violations is usually accomplished without the help of reports from the public. It is difficult to judge the effectiveness of an enforcement program objectively, but it seems that in those provinces which employ relatively well-paid game law enforcement specialists who are secure in the tenure of their jobs, there is best observance of fish and game regulations.

The Royal Canadian Mounted Police, who bear the federal responsibility for enforcement of the Migratory Bird Convention Act and Regulations, have recognized the principle of specialization by announcing as a policy the formation of a special squad for that purpose, but the squad has not yet been formed.

Establishment, Revenue, and Expenditure

Data on staff, revenue, and expenditure for the various fish and game administrations are presented in Appendices 3 and 4. Data on revenues and expenditures were obtained from two main sources, departmental reports and public accounts. It was not always possible to separate expenditures and revenues relative to the commercial fishery from those relating to the sport fishery; thus the data given must be considered as only approximate for comparative purposes. Data on numbers of field staff must also be interpreted with caution since in some provinces many of the persons involved do not do full time work on sport fish and wildlife.

It is difficult to compare the effort put into wildlife management from province to province since there is such variation in the resource, the pressure on it, and the quantity and quality of habitat. Comparisons between provinces of like size and population, located in the same region, may be of some utility.

Some public accounts and departmental reports provide little clue to the exact nature and purpose of certain expenditures. In those provinces, public confidence would probably increase substantially if precise and informative reports were provided.

All Canadian game administrations derive their funds almost exclusively from appropriations by legislatures from general revenue. It will be noted that in many instances the fish and wildlife resource contributes more to general revenue than is appropriated from that source for its management. Since there is a general need for increased effort in fish and game management, particularly for habitat acquisition and maintenance, this policy should be reviewed. Mair discusses this question more fully (9).

The numbers of professional staff employed require to be increased, because of the more intensive management which will be needed to meet the increasing demand for recreational facilities. This is particularly so in the Maritime Provinces.

Recommendation

Limitations of time for study and space for presentation have precluded an exhaustive review of fish and wildlife legislation and administration. A more thorough study would be most useful. A particularly important requirement is to develop criteria for assessment of our fish and wildlife institutions. This is a pressing need because until better criteria are available our attempts to render fish and game management more effective will have to be based on crude, empirical grounds.

Notes

[1] Symington, D.F. *Renewable Resources Information and Education in Canada.* A paper prepared for the 1961 Resources for Tomorrow Conference.

[2] See also Ozere, S.V. *Survey of Legislation and Treaties Affecting Fisheries.* A paper prepared for the 1961 Resources for Tomorrow Conference.

[3] An amendment (1961) to the Alberta Game Act has altered these provisions.

[4] Leitch, W.G. *Problems of a Mobile Resource — Migratory Waterfowl.* A paper prepared for the 1961 Resources for Tomorrow Conference.

[5] Cottam, Clarence. *Pesticides and Wildlife.* A paper prepared for the 1961 Resources for Tomorrow Conference.

[6] Conn, Hugh R. "Indian Treaties as Related to Game management in Canada", *Transactions of the Northeast Wildlife Conference.* Montreal. 1958. pp 183-190. Published by the Department of Game and Fisheries. Quebec, 1959.

[7] Lewis, Harrison F. "The Role of Certain Treaties in Wildlife Management", *Trans. 42nd Conv. Intematl. Assoc. Game, Fish and Conservation Commrs.* Dallas. 1952.

[8] The existence of quasi-public bodies concerned with resource development, but not a part of the normal government structure, presents problems of communication and integration of planning, in addition to those which occur within governments. Relationships between public power corporations and fish and wildlife agencies are cases in point.

[9] Mair, W. Winston. *Elements of a Wildlife Policy.* A paper prepared for the 1961 Resources for Tomorrow Conference.

APPENDIX 1

Legislation Dealing with Game (1)

The Wild Life Act. chap. 197, Rev. Stat. of Newfoundland, 1952.
The Fish and Game Protection Act. Chap. 13, Statutes of Prince Edward Island, 1959.
The Lands and Forests Act (Part 111, Game). Chap. 145, Rev. Stat. of Nova Scotia, 1954.
The Game Act, Chap. 95, Rev. Stat. of New Brunswick, 1952.
The Game Laws, Chap. 153, Rev. Stat. of Quebec, 1941.
The Quebec Fisheries Act. Chap. 154, Rev. Stat. of Quebec, 1941.
The Fish and Game Clubs Act. Chap. 155, Rev. Stat. of Quebec, 1941.
The Game and Fisheries Act. Chap. 158, Rev. Stat. of Ontario, 1960.
The Game and Fisheries Act. Chap. 94, Rev. Stat. of Manitoba, 1954.
The Game Act. Chap. 323, Rev. Stat. of Saskatchewan, 1953.
The Game Act. Chap. 126, Rev. Stat. of Alberta, 1955.
The Game Act. Chap. 160, Rev. Stat. of British Columbia, 1960.
The Game Ordinance. Chap. 42, Rev. Ords., Northwest Territories, 1956. (2)
The Game Ordinance. Chap. 50, Rev. Ords., Yukon Territory, 1958.
The Migratory Birds Convention Act. Chap. 179, Rev. Stat. of Canada, 1952.
The Game Export Act. Chap. 128, Rev. Stat. of Canada, 1952.

(1) See, Ozere, S.V. (op. cit.) for a listing of the Act and Regulations dealing with fisheries.

(2) a revision is expected to be in effect July, 1, 1961.

APPENDIX 2

Sale of Hunting and Angling Licences (non-Residents in Brackets)

(in thousands)

	1938	1948	1958
Newfoundland			
Small game	X	X	12
Big game	.3[1]	5	12
Angling	X	X	9
Prince Edward Island			
Small game	X	X	3[2]
Angling	X	(1) 4	(2) 7
Nova Scotia			
Small game	N	N	2[4]
Big game	17	37[3]	47[5]
Angling	N	N	N
New Brunswick			
Small game	(1) 26	(3) 43	(3) 53
Big game			
Angling	(2) .5	(5) 1	(6) 5
Quebec			
Small game	(1) 6	(2) 102	(2) 111
Big game			(3) 104
Angling	(7) N	(25) 72	(59) 252
Ontario			
Small game	112	150[6]	343
Big game	21	53[6,7]	93[7]
Angling	N	N	(380) N
Manitoba			
Small game	7[8]	15[8]	(3) 32[8]
Big game	5	28	(.1) 26
Angling	N	N	(13) 83
Saskatchewan			
Small game	10[9]	(.4) 29	(4) 59
Big game	1[9]	(.1) 17	(.4) 55
Angling	6[9]	(4) 17	(8) 98
Alberta			
Small game	11[10]	(.6) 27	(2) 98
Big game	7	(.1) 12[7]	(.2) 45
Angling	5	16	129
British Columbia			
Small game	(.5) 26[9]	(2.5) 67[11]	(3.4) 115
Big game (tags)	18	92	X
Angling	(6) 28	(21) 76	120
Totals			
Small game	198	533	828
Big game	69	248	—
Angling	39	186	703

N- not required.
X- not available.
1- 1943.
2- not required by farmers or fishermen.
3- 1947.
4- required only for pheasants.
5- 1957.
6- 1946.
7- deer only.
8- not required by farmers
9- 1940
10- 1941
11- 1950

APPENDIX 3

REVENUE AND EXPENDITURE
FISH AND GAME ADMINISTRATIONS
(in $000.)

	1938-39		1948-49		1958-59	
	Rev	Exp	Rev	Exp	Rev	Exp
Newfoundland	X[1]	X[1]	56	36[2]	173	161
Prince Edward Isl.	nil	nil	10[3]	21[3,4]	18	31[5]
Nova Scotia	50	X[7]	209	X[7]	327[6]	X[7]
New Brunswick	154	95	360	84[8]	494	94[8]
Quebec	403	365	782	1,079	2,234	3,129
Ontario	914	559[9]	2,421	X	4,440	2,940[10]
Manitoba	127	108[11]	539	474[11,12]	670	698[11]
Saskatchewan	100	X	424	133	1,050	413[13]
Alberta	127	85	391	177	780	568
British Columbia	235	275[14]	676	559[14,15]	1,330	1,091
Canada (federal)[16]	nil	50	nil	196	nil	592
TOTAL					12,075	9,594

X — not available

1 — In 1932 the Newfoundland Game and Inland Fisheries Board had an annual income of about $30,000; $15,000 derived from fees and licences, and the balance from general revenue. Report of Newfoundland Royal Commission, H.M.S.O., London.

2 — incomplete

3 — 1950-51

4 — including payments of over $11,000 as bounties

5 — including payments of over $15,000 as bounties for predation control ($8,000 bounties)

6 — revenue for 1959-60

7 — not available because expenditures by Departmental field staff unclassified as to function. In 1956-57 central office expenditures on fish and wildlife were about $71,000.

8 — incomplete because expenditures by Departmental field staff unclassified as to function. In 1948-49, central office expenditures on fish and wildlife were $42,000, and bounty payments, $42,000. In 1958-59, comparable figures were $71,000 and $23,000.

9 — $623,000 appropriated.

10 — includes $53,000 bounty payments.

11 — includes expenditure for predator control and bounty payments (1938-39, $1,000; 1948-49, $17,000; 1958-59, $21,000).

12 — appropriation was $528,000.

13 — incomplete because expenditures by Departmental field staff unclassified as to function.

14 — includes expenditures on predator control and payment of bounties (in 1938-39, $20,000; in 1948-49, $103,000, of which $58,000 was for bounties; in 1959-60, none for bounties).

15 — $618,000 appropriated.

16 — does not include Department of Fisheries or Fisheries Research Board.

APPENDIX 4

Staff Employed By

SPORT FISH AND WILDLIFE ADMINISTRATIONS

	Biologists[2]	Other Conservation Workers
Newfoundland	7	15
Prince Edward Island	none	none
Nova Scotia	1	X[3]
New Brunswick	2	X[3]
Quebec	27	375
Ontario	28	269
Manitoba	9	79[4]
Saskatchewan	8	95
Alberta	14[5]	51[6]
British Columbia	21	84
Canada	34[7]	

1. data assembled by Fish and Wildlife Division, Ontario Department of Lands and Forests.

2. does not include biologists functioning as administrators.

3. cannot be stated because work done by field officers with variety of functions related to resource management.

4. includes field officers primarily concerned with commercial fisheries.

5. includes 4 biologists primarily concerned with commercial fisheries.

6. includes 14 field officers primarily concerned with commercial fisheries.

7. does not include Department of Fisheries or Fisheries Research Board.

X.- not available.

Emerging Problems in Wildlife Management

W.A. Fuller,
Department of Zoology,
University of Alberta.

Wildlife and wildlife diseases do not pose a serious threat to man, but vigilance must be maintained if loss of health and life is to be avoided.

Many kinds of wildlife have caused damage to crops and other interests for some time. In the future, as the need to feed, clothe, and shelter increasing numbers of people forces us to make more intensive use of the land, we will have to concern ourselves more with losses caused by the wildlife that share the land with us.

The increasing human population of Canada will continue to act as a spur to economic activity and therefore pressure on wildlife habitat will continue to increase. The important questions are whether the pressures will be irresistible and whether they can be modified so that their impact on wildlife is not entirely destructive.

Widely held but unfounded beliefs, exemplified by the buck law *school of thought, hamper the amplication of a clear policy on adequate harvests. Administrators and sportsmen are often too conservative to adjust bag limits to harvest the abundance in peak population years. Lack of roads in hinterland areas has sometimes prevented access to abundant game populations, making under-harvest more of a problem than over-harvest. On the other hand, the concentration of human population in urban communities has contributed to extirpation of wildlife in adjacent areas; some species can be eradicated if there is too much pressure. Over-harvest may become more of a problem in some areas in the future because the number of hunters is growing at a greater rate than the population as a whole.*

The majority of people do value wildlife, for various reasons, but if wildlife conservation is to serve the majority, we must modify the widespread belief that economics alone should determine all land use. There seems to be the attitude that since wildlife belongs to everyone it is the responsibility of no one. We can cope with problems of values if an informed public supports ecological research and eventually develops an ecological conscience.

My task is to point out the most crucial problems in wildlife management that are likely to arise in the next 20 years. Obviously, I cannot deal with all the problems involved in managing every species of wild game and sport fish in each region in Canada. Nor would such a recital well serve the purpose of this Conference. I have attempted, therefore, to group them under a few headings derived from my definition of what constitutes a wildlife problem.

A wildlife problem arises when man impinges on wildlife or its habitat, or when wildlife impinges on man or his works. In order for problems to emerge, there must be some change in one of the relationships involving people, wildlife, or their respective habitats. In other words, *emerging* implies a dynamic rather than static situation. It then becomes necessary to identify the dynamic element. It is obvious that the increasing human population of Canada is a dynamic force that is creating and will continue to create wildlife problems.

The first category of wildlife problems includes those where wildlife endangers man or damages his interests. No doubt the first example of this sort coincided with Champlain's settlement in 1608. After the first crop was planted there were undoubtedly birds, and perhaps mammals as well, on hand to share in the harvest. As settlement progressed and agriculture gained in importance, *problems* of damage arose more and more frequently. They remain with us today.

A second category of wildlife problems includes those of preserving essential habitat. The early settlers made much use of wildlife, but there were not enough people to make serious inroads on wildlife populations or to

93452—58

cause much deterioration of wildlife habitats. At the same time and quite fortuitously, the small-scale clearing of the forest actually improved the habitat of most forest species of game, and a slight pollution of lakes and streams by erosion of the land may have improved fish habitats by making available increased supplies of inorganic nutrients. This early situation was one in which a very small human population lived in essential harmony with nature. As the increasing human population made more intensive demands on resources, breaking and clearing of land and pollution of waters went beyond the point of benefiting wildlife, and resulted in habitat deterioration and destruction. These processes continue and thus we still face problems of habitat maintenance.

The third category into which wildlife problems fall centers around the need to regulate the harvest in order to perpetuate the supply. With a few notable exceptions, there was until recently insufficient hunting pressure to cause direct reduction of game populations. Since the end of the Second World War, however, the number of hunters and fishermen wishing to share in the wildlife harvest has increased at a phenomenal rate. There now seem to be enough hunters and fishermen, at least in some parts of Canada, to have a direct controlling influence on populations of many species of game and game fish. Direct pressure of this sort seems certain to increase in the future.

Wildlife problems in the fourth category may be educational, political, sociological, or philosophical. They cut across all of the others and are interwoven with them in complex ways. Primary problems in this category are the establishment of standards of value and their dissemination. Thus we become concerned with wildlife, not so much in the material sense, but as an abstraction — as a component of our *whole life.*

Problems of Damage

On rare occasions an encounter between a person and a wild animal results in injury or death to the person and a subsequent outcry in the press. The most dangerous combination is the grizzly bear and the careless tourist in the western National Parks, but occasionally even a well armed hunter is overcome by his intended prey, perhaps a *gentle* deer. With more and more people entering the woods as tourists or novice hunters, there may be more contacts of this kind and more editorial outbursts for eradication of all bears and abolition of the sport of hunting. Will these intemperate outcries be resisted? I think they will, but the responsibility to reduce the chance of death and injury remains.

Less dramatic, but more hazardous to human welfare are the many diseases and parasites of animals transmissible to man. Scourges such as bubonic plague (black death) are no longer of serious concern, although foci of infection are still with us in ground squirrels and feral rats. Rabies appears to be enzootic in members of the dog and weasel families in several parts of Canada, and migratory bats may be important in reinfecting northern areas from more southerly reservoirs of the disease ([20]). Several strains of the virus-causing equine encephalitis have been recovered from a variety of birds including grouse, pigeons, owls, hawks, shore birds, blackbirds, and sparrows ([13]). Encephalitis was of considerable concern to public health officials in Saskatchewan in 1938 and 1941, and the potential for further outbreaks still exists. Spotted fever and tularemia are also known from Canada, though never in epidemic proportions. All of these diseases will bear watching, but there is no apparent reason why any of them should increase in importance in the future.

In Indian and Eskimo societies, where much wild game and fish is consumed without thorough cooking, parasites of animal origin are common enough to be of concern to public health authorities. Thus, hydatid disease, caused by the tapeworm (*Echinococcus granulosus*), was found in about six per cent of northern Indians ([21]); broad fish tapeworm (*Diphyllobothrium latum)* was widespread in Indians and Eskimos admitted to tuberculosis sanatoria ([26]); and trichinosis *(Trichinella spiralis)* in the Arctic is considered by Connell ([7]) to be "a major public health problem for which there appears to be no immediate practical solution."

I do not foresee this phase of the problem increasing in severity. On the contrary, improved sanitation and decreasing dependence on wild game should combine to produce a lowered incidence of these and other animal-borne parasitic diseases of man.

In summary, wildlife does not pose a threat to the continuance of *Homo sapiens* as a species but nature still bears a sting for those individuals who would court her carelessly.

What I have just been discussing are direct interactions between wildlife and man. There are also many situations in which wildlife affects us indirectly through our forests, crops, or livestock.

We now know that climax forest shelter little game. Creating openings in those forests by fires or logging sets off a complex series of changes in the vegetation. The early stages create ideal conditions of food and cover for several forest game species which may

reproduce so fast that they effectively stop all forest regeneration. As recently as 1955 the Newfoundland Royal Commission on Forestry ([14]) failed to recognize that damage to young conifers by moose was of serious proportions. Such damage is now (1960) causing concern both to the Game Branch and to large timber operators in the Province. In Nova Scotia and New Brunswick, large populations of white-tailed deer may be expected to depress forest reproduction, and in both regions ungulate damage will be supplemented by snowshoe hare damage, particularly in years of hare abundance.

Wildlife affects livestock (including poultry) in two ways – raptorial birds and carnivorous mammals prey on it directly, and herbivores, from mice to moose, compete with it for food. Reducing losses from predators requires improved husbandry, combined in some cases with reduction of the numbers of predators. Experience has taught us, however, that control of animal populations, whether predator or game, is not as simple as it once appeared to be.

Competition for food between big game and domestic animals is severe in some parts of Alberta and British Columbia. On privately owned lands, the needs of livestock should generally have priority. It is questionable whether the same priority should be given to livestock on public ranges. This competition is unlikely to diminish. A carefully worked out policy for the management of public ranges in the public interest is needed.

Probably the most important conflict between wildlife and man arises through destruction of agricultural crops. Both game and non-game species are involved. In Canada, the most pressing current problem is duck damage to grain. The Canadian situation was reviewed by Mair ([19]) and Leitch ([16]). Non-game birds are another cause of damage to grain, vegetables and fruits. Thus, according to a recent review ([11]), 20 species of birds were found to damage 10 agricultural crops in 20 states of the United States. The most serious depredations on both grains and fruits were caused by one or more species of blackbird. In Canada, too, blackbirds cause troublesome problems.

Mammals are not blameless in this respect. Mice, rats, and ground squirrels may do extensive damage, especially to stored grains; mice and rabbits kill fruit and ornamental trees by girdling; moose and elk play havoc with hay stacks.

In theory, big game damage to forests and crops can be controlled by adequately harvesting the game species, but several problems arise here. The first is how does one induce hunters to take a harvest on relatively inaccessible lands? Second, what constitutes an adequate harvest? What density of a given species of game is compatible with the minimum acceptable level of forest reproduction? Research and experimentation oriented toward solution of these problems must be pursued more energetically.

Losses of livestock and agricultural crops could obviously be eliminated by eradication of the offending species. But is this an acceptable, even if feasible, solution? Clarke ([5]) says that Canadians accept and value wildlife. If this is so, and I believe it is, then some other solution must be found. On the other hand, attempts to control the numbers of wild animals have often run into difficulties, some predictable, others not. For example, reduction of coyote numbers to reduce predation on livestock has often been followed by plagues of crop-destroying mice. Often, too, the economic loss from the mice exceeded that originally attributed to the coyotes. Do we know for sure that this is a cause and effect relationship? If so, can we devise means for keeping the mice in check? If it is necessary to control or reduce wild animal numbers, can we devise methods more efficient (and humane) than the use of guns, traps, and poison? The use of repellents is increasing. Another promising approach might be through altering the physiology of the animal rather than outright killing. The active ingredient in the *poison* baits of the future may be something which inhibits reproduction.

In summary, wildlife damage of many kinds has been with us for a long time. However, our concern over the damage sustained has varied according to the offending species. In general we have persecuted predators of poultry and livestock, but have shown a good deal of tolerance toward many of the herbivores that attack forest, field, or orchard. In the future, though, as the need to feed, clothe, and shelter increasing numbers of people forces us to make more intensive use of the land, we will have to concern ourselves more with losses caused by the wildlife that shares the land with us.

Problems of Habitat

It is axiomatic that wildlife needs a place in which to live. Equally true, but less obvious perhaps, each species of wildlife has its own special requirements of habitat. This dependence has arisen through a long evolutionary history. Thus, white-tailed deer, coyotes, pheasants, and carp can thrive in close association with agriculture, Mule deer, wolves, spruce grouse, and rainbow trout cannot. A third generalization is that wildlife, like trees and agricultural crops, is a product

of the land. In some cases the interests of the farmer or forester parallel those of the wildlife manager; in others they do not. Before attempting predictions, let us look briefly at some of the conflicts that have already arisen.

The oft-told story of the disappearance of the bison may serve as our first example. There were many factors involved that need not concern us here, but the overriding factor is that bison is not compatible with the raising of livestock or grain-growing. Without the hide-hunters the bison would have held on a little longer, but only until the plains were fenced.

Agriculture is crowding out another great migratory resource in a slightly different way. I refer, of course, to the drainage of duck-producing potholes to raise crops that are often surplus from an economic viewpoint ([16]).

Forestry, by its very nature, alters wildlife habitats. Forests disappear altogether, or the composition of the forests changes. The effects on wildlife are a mixed blessing. The creation of openings in the forest and the abundance of young growth, following a logging operation, certainly benefit the white-tailed deer. This species will remain the major component of our big game crop. These same changes in habitat, however, have pushed the woodland caribou farther and farther back into the wilderness. Forestry also affects fish in various ways. Removing the trees that shade a stream leads to a rise in water temperature that may render a stream unsuited to some species, notably the trouts and chars. Bad forestry practices, such as clear cutting and destruction of ground cover, lead to increased erosion, and this in turn gives rise to silt-laden streams no longer suited to the production of fish.

Both forest and agricultural crops are beset by insect pests. To combat these, the chemical industry has developed some effective sprays that can be spread over immense areas by the use of aircraft. This problem, too, has such significant implications for wildlife that a separate paper ([8]) has been devoted to it.

The development of hydroelectric power may have far reaching effects on wildlife, particularly fish (2,15).

One of Canada's newest major industries is the petroleum industry that blossomed in Alberta in 1947. In the intervening 13 years, almost 700,000 miles of exploration and seismic trails have been bulldozed through the forests of Alberta in the search for oil (Heustis, *personal communication*). Thus 1.5 to 1.8 million acres of wildlife habitat have been altered rather drastically. Worse still, there have been cases of rival companies pushing through parallel roads only a few yards apart, thus unnecessarily doubling the amount of destruction.

People, too, need living space. In the postwar years, many of our cities have known the phenomenon of *urban sprawl*. My own home in Edmonton, for example, sits on land that was a lake until after World War II. J.Dewey Soper (*personal communication*) remembers trapping muskrats in that lake in his youth. Nor are people content to sit at home; the automobile has given us a civilization on wheels. Just how important a factor this is may be appreciated from the following quotation ([12]): "Modern traffic, like a many-bedded river, has torn wide gashes through today's central cities and has carried beyond the city large chunks of urban enterprise which now will never return to the centre ... in some cities traffic takes up twice as much land as is given to all other forms of human occupancy ... this ratio, as high as it is, is still not high enough – it must increase."

Finally, there is the gigantic problem of pollution of lakes, streams, and even the oceans with industrial wastes. Larkin ([13]) deals with the effects of pollution on fish. Waterfowl and sea birds are probably the classes of wildlife next most vulnerable to pollution, especially when the pollutant is oil. Giles and Livingstone ([10]) reported heavy losses in sea-bird colonies off the coast of Newfoundland. On both our coasts, the problem is a particularly difficult one because in some cases the oil is dumped, or ships' bunkers are flushed, beyond our territorial limits. Wind and currents combine to sweep the oil toward shore.

Turning now to the future, I think we may anticipate some new areas of conflict.

At present two tremendously large regions of Canada are barely touched by economic activity – the Pre-Cambrian Shield and the arctic tundra. These act as very large preserves for some species of game. What will happen when the world's insatiable demand for paper makes it economically feasible to harvest the scrubby pines and black spruce of the Pre-Cambrian? Of more immediate concern, will the search for oil in the Arctic result in destruction of the tundra on the same scale as the destruction of Alberta forests? If so, can the tundra, usually thought of as a rather fragile biome, withstand such destruction?

Finally what of nuclear power? Will we dump radioactive wastes into our rivers? How many trout streams will be used to cool a reactor? How much wild land will be fenced off around each reactor site to protect the public from accidental exposure to harmful radiation?

The present situation may be summed up, by saying that various forms of economic activity have created, and are creating, pressures on wildlife habitat. As a result, habitat for many forms of wildlife is shrinking. The increasing human population of Canada will continue to act as a spur to economic activity. One may confidently predict, therefore, that the pressures of those activities on wildlife habitat will continue to increase. The important questions are whether the pressures will be irresistible, and whether they can be modified so that their impact on wildlife is not entirely destructive.

Problems of Harvest

How to obtain a harvest that just balances productivity is now, and always has been, the central problem of the art of wildlife management. The harvest problem may be considered under two headings – over-harvest and under-harvest. At first sight over-harvest might appear to be the more serious. However, examples in which wildlife populations have been exterminated by over-harvest alone are rare. The near extermination of the bison is one of the best, although the bison was doomed by the advance of agriculture anyway. The timber wolf, too, has been steadily reduced in numbers because of relentless persecution by man. In many other cases, over-harvest has been only one factor working in combination with other factors, chiefly habitat destruction, which is discussed in a later section. This seems to be true of the barren-ground caribou and the whooping crane for example.

Under-harvest usually results in one or more undesirable effects. By definition there is waste of part of the game crop. If an overabundance of a game species occurs close to agricultural crops, crop damage frequently results. Most serious, however, is the extreme case in which the animals literally eat themselves out of house and home. Many years may then elapse before the habitat recovers sufficiently to support a harvestable stand of game again.

The control of over-harvest poses several difficulties, some biological and some essentially political. The political problems of securing suitable restrictive legislation and adequate enforcement staff lie beyond the scope of this paper. They are dealt with by Munro ([23]). Perhaps the chief biological problem is the difference in sensitivity to exploitation exhibited by different species of wildlife. Thus we have a somewhat paradoxical situation in waterfowl management where some species, notably mallards, are so abundant that they cause important crop losses, while other species, notably canvasbacks and redheads, are faced with local extermination. In a different situation – the great boreal forests – it is well known to trappers that marten and fisher can be easily caught and quickly eradicated, whereas the red squirrel cannot be exterminated by trapping alone. A final example may be drawn from the fishery field, where there seems to be no practical limit to the angling pressure that the warm water species can withstand. There is a definite limit, however, to the amount of angling that the slow-growing trouts and chars of the cold mountain streams can stand.

The problem is most acute when scarce and abundant species occur in close proximity, as with the waterfowl. To harvest mallards and protect redheads it is obviously necessary for the hunter to know one species from the other. Does this foreshadow the day when prospective hunters will be required to pass a test on their knowledge of wildlife?

Under-harvest is always associated with one of two things. The first is difficulty of access to the game crop. In the case of ungulate populations this is caused by lack of roads, coupled with the disinclination of the modern hunter to leave his automobile and travel on foot. To mention only two examples, this factor is at the root of the moose problem in Newfoundland forests and an overpopulation of elk in parts of Alberta. In the case of small game the deteriorating relations between the sportsman and the landowner are more often to blame. Essentially this is a social problem; it will be discussed, along with problems of values, in part four of this paper. Fishermen too have access problems. Lake Simcoe, within easy reach of the dense population of fishermen in Metropolitan Toronto, contains an overabundance of harvestable fish. However, the lake is ringed by privately-owned land so that only a handful of fishermen can actually get access to the water during the summer. The anomalous situation has developed wherein fishing pressure is heavier in January than on a sunny Sunday in July, simply because in January the public has free access to all parts of the lake on the ice. (C.H.D. Clarke drew this example to my attention.)

The second general cause of under-harvest is based on some of our attitudes toward wildlife. I am thinking particularly of the *buck law* school of thought. It has been demonstrated again and again that adequate harvests cannot be obtained when only adult males are hunted, yet opposition to harvesting females and young, particularly of ungulates, continues. The fisheries people in general have had more success in ridding themselves of such ancient shibboleths. Thus minimum sizes and daily possession limits have gone by the

boards in many fertile lakes where overpopulation of some species has been demonstrated.

For many Canadian species of small game, fur-bearing mammals, and upland game birds, periods of great abundance alternate with periods of scarcity. Thus, problems of securing an adequate harvest may be replaced by the problems of preventing over-harvest in a short space of time. Biologists recognize the phenomenon and can usually predict the year of maximum harvest, but administrators and sportsmen are often too cautious to raise bag limits in time to cash in on the periodic bonanzas.

What now of harvest problems in the future? Clarke's [5] analysis of the increased numbers of hunters and fishermen in Canada in recent decades gives reason for apprehension, if not alarm. He shows that the number of hunters and fishermen increased by a factor of three or four while the population of Canada was doubling. Alberta has had the greatest increase. The number of hunting licences sold in 1958 was greater by a factor of 10 than the average number sold per year in the first 44 years of this century [22]. There seems little reason to doubt that the population of Canada will continue to increase, but it is less certain that the more-than-proportionate increase in hunters and fishermen will continue as well. If this trend does continue, however, problems associated with over-harvest may assume a dominant role.

Problems of Values

Sociological problems arise out of differences in our attitudes toward wild things. Clarke [5] has examined our attitudes in some detail, but their importance is such that I must refer specifically to several here.

A basic dichotomy arises because most species of wildlife have both negative and positive values, and seldom is the line clear-cut. Few mammals contribute more in a positive way than the beaver, and certainly none has contributed more in the past, yet even the beaver has negative values when its activities lead to washed out highways. At or near the other end of the scale are the raptorial birds and the large predators such as the wolf. Most people see in the swoop of a hawk or the howl of a wolf only a threat to either their economic well-being or their favorite sport. Only those with an *ecological conscience* [18] perceive, in those events, the drama of evolution. When and how are we to protect and preserve our large wild predators? Will Canada be richer or poorer if they are lost?

There is a secondary dichotomy even among those who stress the positive values of wildlife. The hunters and trappers are consumptive users of wildlife whereas bird watchers, camera-hunters,and just plain nature lovers are nonconsumptive users. Furthermore, even the consumptive users are divided into factions. For example, there are the *bucks only* school and the *any deer* school; the pot hunter and the trophy hunter; the treblehook fisherman and the dry-fly addict.

I believe that those who value wild things are in the majority, but unless they set aside their differences and pull together they are in danger of losing out to the minority by default. Will we see a united front for conservation of wildlife in the next 20 years? How can we help to bring it about?

If wildlife conservation is to serve all the people we must modify the widespread belief that economics alone determines all land use. Leopold [18] has branded this "the fallacy that economic determinists have tied around our collective necks." Regardless of any peregrinations of the gross national product, Canada will be irreparably poorer if, as a result of economic pressures, we lose a single species of our native wildlife. Who will teach ordinary Canadians about the esthetic values of wildlife? Will we recognize those values before we lose them in the face of economic *progress?*

In many cases people who should know better are engaging in bad conservation practices. I can do no better than quote with approval from a recent writer [4], a polymer chemist by profession.

> "Ignorance of a similar kind is found in technology, philosophy and science. For example, it may be discovered that a certain spray will be extremely effective in killing mosquitoes, or their larvae. Wholesale spraying, then, of parks, fields, streams, does indeed kill off the mosquitoes, but also the birds and fish which, had they been fostered, might have done a reasonably good job in the first place. (Solutions which pertain to be absolute – "to kill off *all* the mosquitoes" – should on principle be avoided, or in any event, thoroughly scrutinized.) This kind of error lies in mistaking analysis for all there is, or in looking at a complicated system with a very low-level-of-abstraction viewpoint, narrowly restricted. The proper functioning of analysis, synthesis, and reduction to practice would lead one to think of the whole situation. This is what ecologists are trained to do, and a well-trained ecologist would not commit such mistakes."

If the scientists themselves cannot reach agreement, can we expect to get the message across to the general public?

Canada, like the United States, owes a great deal to its early pioneers. Those pioneers treated the wilderness as something to be conquered, and with their energy, fortitude, and indomitable will, conquer it they

did. For most Canadians now the frontier exists only on television, yet it is surprising how much our attitudes toward wildlife are still coloured by the pioneer tradition. Witness, for example, the titles of two recent books – *Men Against the Frozen North* (3) and *Three Against the Wilderness* (6) Stefansson refuted Calder as long ago as 1921 with *The Friendly Arctic* (24) and a reading of Collier's book discloses that the wilderness treated him very well and that he is in fact very much on the side of the wilderness. One can only presume that the titles were intended to attract a wide readership by appealing to the remnants of our pioneer spirit. Thus we keep alive the idea that the wilderness is an enemy. This may promote book sales, but hardly provides the background for good conservation.

Finally, there is evidence of an enormous indifference toward wildlife. It probably has its roots in the attitude that, since wildlife belongs to everyone, it is the responsibility of no one. This theme has been elaborated by the Editor of *The Atlantic*, an ardent fisherman who writes poetically about the New England States, the Maritime Provinces, and Newfoundland. I should like to quote from a recent editorial (25).

> "As everyone who is interested in water knows, it is the devil and all to keep a good river alive... The river I most love, the Northwest Miramichi, has- or had – in its upper water an exceptionally deep and beautiful pool, at a curve in the river known as Black Pool, because of the shade cast over it by a giant, century-old pine. Prospectors camped at the point, and wanting a quick way to cross the stream, simply felled the tree to provide their foot-bridge; the chunks of it which protruded were sawed off and dumped into the pool. The metallurgists in charge of the party and the French Canadians saw nothing but efficiency in this desecration."

To me, such small acts of personal indifference are more frightening than the large, impersonal acts of many corporations and cities. The individual may understandably be indifferent to pollution of the St. Lawrence, for, after all, what can one person do to stop that? On the other hand, indifference of a few individuals led to the desecration of Black Pool. I think we must attack the problem on an individual level and perhaps, if we succeed in instilling a sense of ownership of wildlife into individuals, more corporations will develop an *ecological conscience*.

Discussion and Conclusion

In the next few decades the problems in wildlife management are not going to change in essence. They will manifest themselves in new places as man's activities are extended into hitherto unexploited areas. They will intensify as more and more people cluster in our present centres of population. More than anything, we need to anticipate our problems and develop the will to meet them in good time.

Earlier in this paper I referred to possible destructive influences on the tundra. It seems to me that this example epitomizes our future problem. There seem to be two basic unknowns. First, if the tundra community is damaged, can it recuperate and if so, how long will it take? Second, whether or not the damage is permanent, will we allow the tundra community to be squeezed out of existence by burgeoning economic pressures such as the search for oil or, far into the future, perhaps, tundra agriculture? The answers to the first group of questions can come only through basic, ecological research (9). For problems of the second kind, involving attitudes toward wild things, the only hope is in educating all Canadians to an appreciation of their natural heritage.

What is required then is a double-barreled attack – first to acquire new knowledge and second to see that what we know now and may come to know is widely disseminated. So far we have been better at learning than teaching. One example will have to suffice. Game managers have long since proved the inefficiency of bounties for the control of predators, yet bounties are a perennial item on the agendas of Fish and Game Association Conventions and they still figure in the budgets of some Game Departments. What we need, therefore, is not less ecological research, but more, much more, emphasis on education. Other branches of science are faced with the same problems (1). Nor are the two types of problems unrelated. A public that wants to preserve our wildlife heritage will more actively support ecological research, and accept research findings, than a public that doesn't know, therefore doesn't care.

The aim of education in this field is to develop an *ecological conscience*. This implies recognition that wildlife is part of the land community with which we must live in harmony rather than in a state of war. As a part of the land community, wildlife should receive consideration in all programs involving land use. The contribution of wildlife must be considered in esthetic as well as economic terms, and in some cases, at least, the esthetic values should be recognized as truly priceless.

The task is formidable, but not without hope. As Aldo Leopold has said: "to promote perception is the only truly creative part of recreational engineering."

References

[1] Ashby, E., "Dons or Crooners?" in *Science*, No 131. 1960. pp. 1165 – 1170.

[2] Boan, J.A., *The Significance of Reservoirs in Recreation*. Paper prepared for 1961 Resources for Tomorrow Conference.

[3] Calder, R., *Men Against the Frozen North*, George Allen and Unwin Ltd. London. 1957. pp. 279.

[4] Cassidy, Harold G., "The problem of the Sciences and the Humanities. A diagnosis and a prescription" in *American Scientist*, No 48. 1960. pp. 383-98.

[5] Clarke, C.H.D., *Wildlife in Perspective*. Paper prepared for 1961 Resources for Tomorrow Conference.

[6] Collier, Eric., *Three Against the Wilderness*. E.P. Dutton and Co. Ltd. New York. 1959. pp. 349.

[7] Connell, F.H. "Trichinosis in the Arctic: a review", *Arctic*, No 2. 1949, pp. 98–107

[8] Cottam, C., *Pesticides and Wildlife*. Paper prepared for 1961 Resources for Tomorrow Conference.

[9] Cowan, I. McT., *Research in Relation to Management Needs*. Paper prepared for 1961 Resource for Tomorrow Conference.

[10] Giles, Lester A. Jr. and J. Livingstone, *"Oil Pollution of the Seas"*. *Trans. North. Am. Wildl. Conf.* 25. 1960. pp. 297–303.

[11] Giltz, Maurice L., *The nature and extent of bird depredation on corps*. *Trans. North Am. Wildl. Conf.* 25. 1960. pp. 96–99.

[12] Haskell, Douglas, "More Land Said Needed for Traffic" *Edmonton Journal*. October 19, 1960.

[13] Johnson, H.W., "Public health in relation to birds. Arthropodborne viruses". *Trans. North Am. Wildl. Conf.* 25. 1960. pp. 121–133.

[14] Kennedy, H., D.R. Cameron and R.C. Goodyear, *Report of the Newfoundland Royal Commission on Forestry*, Queen's Printer. St. John's. 1955. pp. 240.

[15] Larkin, P.A., *Effect of Man-Made Changes on Fish Environment*. Paper prepared for 1961 Resource for Tomorrow Conference.

[16] Leitch, W.G., *Problems of a Mobile Resource – Migratory Waterfowl*. Paper prepared for 1961 Resources for Tomorrow Conference.

[17] Leopold, Aldo, *Game Management*. Charles Scribner's Sons, New York. 1933. pp. 481.

[18] ---------, *A Sand County Almanac*. Oxford University Press. New York. 1949. pp. 226.

[19] Mair, W. W., *"Ducks and Grain"*. *Trans. North Am. Wildl. Conf.* 18. 1953. pp. 111–117.

[20] Martin, R.L., "A history of chiropteran rabies with special reference to occurrence and importance in the United States" *Wildlife Disease*, 3. 1959. pp. 1–75.

[21] Miller, Max. J., "Hydatid Infection in Canada" *Journal of Canadian Medical Association*, 68. 1953. pp. 423–34.

[22] Mitchell, George J., *Alberta's Upland Game Bird Resource*. Queen's Printer. Edmonton. 1959. pp. 27.

[23] Munro, D.A., *Legislative and Administrative Limitations on Wildlife Management*. Paper prepared for 1961 Resources for Tomorrow Conference.

[24] Stefansson, V., *The Friendly Arctic*, The MacMillan Co. New York. 1921.

[25] Weeks, Edward, "The Peripatetic Reviewer", *Atlantic*, 206, 1960. pp. 114–15.

[26] Wolfgang, Robert W., "Indian and Eskimo Diphyllobothriasis" *Journal of Canadian Medical Association*, 70. 1954. pp. 536–39.

A Review of Wildlife Research in Canada

Ian McTaggart Cowan,
Head, Department of Zoology,
University of British Columbia,
Vancouver, B.C.

The need for basic or applied wildlife research increases directly with the pressure of human induced circumstances on wildlife.

With few exceptions we now know our fauna and its general distribution. Reasonably detailed analyses of distribution within provinces are now needed for purposes of conservation. In addition, it is important that land areas be specified which are imperative to the survival of useful wildlife stocks.

The increasing demand for wildlife requires continuous research leading to the improvement of aerial and ground census techniques and techniques for determining kill.

The techniques of habitat appraisal seem adequate for present needs, but more research is needed to determine what it is in the habitat that limits the distribution and abundance of wildlife species in it.

Early population research was largely of a statistical nature and did not provide the basis for understanding fluctuations in numbers of certain species. More studies are needed which attempt the analysis of all forces acting on and within a population to influence its size. Although some Canadian research on life history and behavior is rather superficial, other studies are among the most ambitious and integrative yet attempted.

The largest body of published data on any wildlife group is that dealing with waterfowl. Several important studies lie buried in files, however, and their publication will equip us with an unparalleled body of data on which to develop our philosophy and practice of waterfowl conservation.

Almost every province in which big game species are of importance is conducting some sort of investigation to yield local information required for immediate application. The caribou has been the subject of the most ambitious study of big game species.

Several of the marine mammals of Canadian and Arctic waters have been the subject of researches that sought information on the important management characteristics of stock size, distribution, movements, reproduction and replacement, food sources, and the human impact.

While research on the fur-bearing carnivores has been neglected, rodents have received more attention. With the beaver, as with several other wildlife species, we have actually acquired a great deal of information, but an understanding of the mechanics of depression, and the ability to forecast population behavior, still escape us.

As yet we have only the most superficial knowledge of the parasites and diseases of wild animal species and know almost nothing about the epizootology of disease in wildlife. The study of wildlife diseases continues to be one of the most fruitful and potentially important areas for research.

The most vexing problems to be solved in wildlife damage are those of waterfowl damage to crops and of rodent damage to forest seed and young trees. As yet our attacks on these problems have been prosaic and the results do not measure up to needs. Failure to solve the problems by techniques that discourage damage without eliminating the animals will lead to the destruction of valuable and interesting wildlife.

Although wildlife research in Canada has done a creditable job of preliminary exploration, we must continue and expand research at all levels, but six areas are of special importance:

1. *Research on the development of management techniques.*
2. *The question of self-regulation of animal numbers.*
3. *Determination of the extent and effect of animal parasitism and disease.*
4. *Physiological and functional mechanisms of adaptation.*
5. *The operation of hunting pressures and what factors affect them.*
6. *The economics of land use for wildlife.*

Introduction

Research is a term used in a variety of contexts and with different meanings in different areas. As it applies to the study of wildlife species it has seemed proper to differentiate between studies or investigations designed to contribute to the improvement of a technique, or to yield some facts of immediate importance to management on the one hand; and on the other, studies that contribute to an increased understanding of a principle, and those that discover new facts about a species or a situation, and relate these to the existing body of knowledge.

The term wildlife is frequently used in its extended sense to include all vertebrates other than fish. The present review will be primarily concerned with the large mammals, the fur bearing mammals, waterfowl, and gallinaceous birds. However, studies of any species that contribute importantly to the understanding of principles of major concern to the wildlife biologist have been included. Studies primarily of a taxonomic or faunistic or floristic nature have generally been excluded.

Research in wildlife, whether motivated solely by a desire for more knowledge or oriented toward the needs of management, may be concerned with subjects such as the behavior of populations, the natural regulation of animal numbers, animal disease, the interaction of wild animal species, and the impact of wildlife on crops, domestic animals, and on man himself. These problems and the ramifications arising from them have formed the core questions around which more wildlife research has developed.

The knowledge and understanding demanded for the successful management of any species increases directly with the pressure of human induced circumstances on it. Thus in a primitive environment where all constructive and destructive forces are actively at work with only the minimum of human interference, about all that is necessary to use the resource is the basic understanding of local distribution and behavior of the creature requisite for successfully hunting it.

In a rapidly developing country such as Canada, where the use pattern is proceeding directly from the primal nomadic hunter culture through the agrarian to the urban industrial culture, a much greater understanding is paramount. The interference with native habitats and wildlife species, the destruction and creation of wildlife habitats, the growing demands on wildlife to supply recreation rather than food and clothing, have presented a constantly increasing demand for information of an ever more sophisticated nature in order merely to meet the day to day needs of designing management practices.

The purpose of this review is to take stock of the wildlife research undertaken in Canada and to attempt an assessment of the extent to which it has met current needs and at the same time provide the basis for expanding our understanding of the increasingly complex problems that wildlife conservation will present.

For purpose of this appraisal it has seemed useful to categorize areas of research and to review these in some sort of logical order that will suggest the series of phases through which the development of our understanding of the Canadian wildlife resource has proceeded.

In any region it has first been necessary to know what species were present and how they were distributed. It became obvious then, that species were nowhere evenly distributed over large areas and more detailed study of habitat requirement became the pattern. The developing concepts of plant succession and synecology then led to a great emphasis upon the floral constitution of the environment and its capacity to support wildlife.

More recently the emphasis in research has shifted toward the study of the individual animal, the study of the behavior of populations and the pursuit of data relating to particular phenomena rather than the general pursuit of biological information on a species.

Faunistic Surveys

The exploratory phase of wildlife research is now virtually complete for practical purposes. We now know our fauna and its general distribution. The only exceptions are certain rare or elusive species and a few remote portions of the Arctic Islands, and in almost every instance the research necessary to fill these deficiencies is in progress.

The woodland caribou is almost alone among the species of game mammals with an imperfectly known distribution. The recent studies by Manning (60) have pointed out that there are still areas within the possible range of the Peary caribou that have escaped study. These are on the islands of the high Arctic where the biologists of the Canadian Wildlife Service, the Arctic Institute and the Fisheries Research Board are actively conducting explorations that will provide the data on this and other Arctic wildlife species.

The studies of Soper (74), Gavin (42), Cooch (18), Fuller (38) and others have, in the last few years, almost completed the task of identifying the nesting grounds of the important populations of Arctic and sub-Arctic migratory game birds. One species, however, still lacks vital details of its distribution. The nesting ground of the largest part of the trumpeter swan population remains undiscovered.

With the determination of the general distribution of animal species across Canada, reasonably detailed analyses of distribution within Provinces become of increasing importance for purposes of conservation. These should proceed until the seasonal movements of local populations are known and critical summer or winter ranges of seasonally mobile stocks have been described. This task has been proceeding in almost all provinces. Handbooks are available on birds or mammals or both of British Columbia, Alberta, Saskatchewan, Ontario, and Newfoundland. Where such handbooks are not available they should be prepared as useful background sources of information. Some of those in existence, notably of Ontario, are inadequate and should be replaced. These works, however, are general in nature and do not provide details of local distribution upon which management must be based.

It is particularly important to evaluate as soon as possible existing areas of wild land in terms of the wildlife resource. Several provinces have refined information for some species and certain regions in working files. It would, however, be valuable to publish the data, not only because it would be useful to those interested in wildlife management, but also, and just as importantly, it would identify and designate certain critical land areas for reference by land-use planners in other government departments. Until we can specify the land areas that are imperative to the continued survival of useful wildlife stocks, we will be unable to discharge our responsibility to protect and develop these areas.

Census of Wildlife

A knowledge of the size of a population, or, alternatively, of changes in numbers, if accurate estimate of total numbers cannot be ascertained, is among the most useful data the wildlife conservator can obtain. Only upon this type of data, obtained within reasonable limits of accuracy, can intelligent management procedures be designed. The greater the pressure on a species, the more important becomes the accuracy of estimate and the narrower become the tolerance limits of error. Thus it is that increasing demand for wildlife requires continuous research leading to the improvement of census techniques.

The great distances of Canada have indicated the aircraft as the most suitable tool for wildlife census. Surprisingly, we have, in general, been ready to accept techniques of aircraft census developed elsewhere under very different conditions, and very little research has been directed toward improvement of accuracy or the adaptation of existing practices to other species and situations.

Edwards (31) in British Columbia has set out the conditions and the expectable accuracy for aerial census of moose in mountainous forested regions. There are, also, experimental studies of the use of aircraft for moose counts in Ontario but the results are not yet available.

The British Columbia Fish and Game Branch has used aerial census of moose for several years and appraised the results critically. They conclude that the rapid alteration of moose distribution in mountainous country, in response to short term changes in behavior induced by weather and other circumstances, render the techniques available of little practical use.

Only the first reports have been released of the important study in progress in Manitoba by Taggart and Bossenmaier (82) on the use of photointerpretation in big game census. Results of the first trials give promise of a useful technique where circumstances for its application are suitable.

There is now a considerable body of experience available in the assessment of populations of such species as bighorn, elk, deer, moose, pronghorn, caribou, barren-ground grizzly, and wolf. The over-all results appear to satisfy the needs of management in existing circumstances. The most extensive aerial surveys have been those conducted by the Canadian Wildlife Service in making herd counts of barren-ground caribou, and by the same Service, in cooperation with the United States Fish and Wildlife Service, in the annual waterfowl inventories. In the latter especially, there have been extensive and detailed studies by both national services designed to reveal the weaknesses of existing methods and to provide the basic information upon which improved practices can be designed. The results have not yet been published.

Techniques have been developed to permit the use of aircraft in estimating populations of beaver in the Arctic and sub-Arctic (39) and muskrat on prairie sloughs by lodge or push up counts.

The federal agencies and some provinces also are experimenting with the use of the helicopter, but no imaginative operational research has so far been undertaken. The cost of this type of equipment has hitherto discouraged its use.

Aircraft census is expensive and merits the closest examination to determine the circumstances that influence accuracy. Inasmuch as day to day changes of weather are known to profoundly alter the results, both by altering the distribution of the animals and by changing the effectiveness of vision from the aircraft, such census cannot be scheduled far in advance and not nearly enough is known to permit the effective planning

of counts offering comparable results from one year to the next. It is urged that more critical research on this aspect be undertaken so that the aerial census can find its proper place as a refined and acceptable wildlife management technique.

Experimental attempts to assess bighorn populations by total inventory of individual herds from the ground have given reasonably satisfactory results (21) but were not subjected to repetitive checks to determine the limits of accuracy.

I am not aware of any Canadian research aimed at producing more refined techniques for estimating the populations of the host of wildlife species that cannot be studied from the air. It seems to me that there is a growing need for research to discover, perfect, and test the many ingenious possibilities for enumeration that can arise from index techniques. These have been largely neglected in Canada. Lack of research effort in census techniques has left us in a position where we are unable to estimate the sizes of many of our wildlife stocks, or to be sure of alterations in size that result either from management practices or the lack of them. As pressures on our resource increase this lack will become increasingly prejudicial to effective management.

The study in progress by Gollop of the factors associated with banding and recovery of waterfowl that influence results is an example of the type of critical appraisal that is badly needed in the field of population measurement.

Of almost equal importance to management is the somewhat simpler task of measuring harvest. Several provinces have been using mail sampling of hunters for assessing the kill and there have been a number of studies designed to determine sources of bias and means of offsetting them. The results are available and should be more widely applied. There is, however, need of further research on the techniques for determining kill, in order to develop the parameters that must be observed to obtain results to a degree of accuracy predetermined to meet the needs of each situation.

Habitat Appraisal

The detailed description of habitat presents a much simpler problem than the determination of animal stocks. Plant cover stays put while you work on it. Clarke, *et al* (16) described a technique for ground cover assessment by point sampling that has been widely used in appraisal of wildlife range. Shrub cover is usually measured by line point or line intercept methods, and tree density by one of several techniques developed by foresters. Canadian workers have published no work on improvement of techniques, but those available seem adequate for present needs. The main problems arising are those of sample distribution to permit meaningful description of larger areas.

We can determine and describe habitat of varying capacities for the support of wildlife; but in only a very few cases has there been any successful attempt to determine what it is in the habitat that limits the distribution and the abundance of wildlife species in it (23). This is a most fruitful and important area for further research.

Population Research

Wildlife management is the manipulation of populations of animals and of men. It follows, therefore, that an understanding of the nature and mode of action of all the forces that interact to build, destroy, and maintain an animal population is fundamental to the task.

Interest in the question of population behavior of animals began largely as a consequence of the violent fluctuations in the availability of certain species, such as Canada lynx, to the raw fur markets. Early research was largely of a statistical nature, based on the catch figure, and though it served to outline the gross picture of repetitive fluctuations in numbers of snowshoe hare, lynx, marten, and other species (13, 35, 55, 20), it did not provide the basis for understanding them. Exploratory studies have revealed the widespread occurrence of cyclic population fluctuations in temperate and cold climates, and have recently contributed some understanding of the mechanisms involved in the self-regulation of the numbers of the herbivorous species (14). However, almost all the research to date has been outside Canada. Scientists in the United States of America, in Britain, Finland, and Australia have made greater contributions than Canadians to the many fundamental questions that have arisen, even though the problems presented are of the greatest importance to Canada.

Because population research involves the study of individual stocks over periods counted in generations of animals, most emphasis has been directed toward short lived species with a quick population turnover. This area of research, more perhaps than any other, has demonstrated the need for fundamental information sought where it can best be obtained and without any thought of immediate applicability to management. Research on protozoans, insects, and mice is here of the greatest importance in developing an understanding of principles equally applicable to the larger species.

Uncompleted studies of the snowshoe hare and sharp-tailed grouse by Rowan of the University of Alberta; the study of barren-ground caribou by Banfield (3,5),

Kelsall (51) and others; the study of lemming populations now in progress by Krebs of the University of British Columbia, of the blue grouse by Bendell (7,8) of British Columbia, and of the pheasant by Stokes (80) at the University of Wisconsin, are the only Canadian studies known to me that attempt the analysis of all forces acting on and within a population to influence its size. There are, however, many excellent studies completed or in progress on various, more circumscribed aspects of the over-all problem. Most of these fall into the categories of wildlife disease or of environmental physiology and are treated under those headings. A recent notable contribution has been the experimental study by Bendell (9) of the influence of food on populations of white-footed mice *(Peromyscus spp)* in the wild.

The elucidation of the mechanisms of population control in the larger carnivores has not been attempted in a single instance and yet these are the species in greatest threat from advancing civilization. The need for such information is urgent.

While an understanding of the factors that control size and productivity of population is fundamental to wildlife management, there is not one Canadian research worker devoting his full time to population problems. This differs greatly from the situation in entomology and fisheries management where many workers are studying such problems.

Arising out of the needs of population research there have been several studies to develop techniques for aging the pinnipedia, certain rodents, and the ungulates. Notable among these has been the work of Mansfield and Fisher (62) on age determination in seals by use of growth rings on their teeth. Similar studies have been made by Sergeant and Pimlott on moose (73), Sergeant on toothed whales (71), Olsen on muskrats (66), and Banfield on caribou (5). The use of the sectioning technique on the teeth of ungulates was an important breakthrough in the determination of age in species from which such data could not previously be obtained.

Life History and Behavior

A large body of Canadian Wildlife research is most conveniently treated under this heading. Many are rather superficial studies designed to establish the general context of the gambit of positive and negative forces that combine to circumscribe a population of animals. Others are among the most ambitious and integrative studies yet attempted.

Waterfowl

The largest body of published data on any wildlife group is that dealing with waterfowl. The greatest part of this has quite naturally emanated from the Prairie Provinces and as a direct or indirect result of the activities of the Delta Waterfowl Research Station at Delta, Manitoba. Hochbaum's two books (48, 50) and the one by Sowles (76) set a high standard both of research and of writing, and have contributed importantly to a widespread increase in the understanding of the problems of waterfowl conservation.

The more than 30 shorter publications that have arisen from studies at the Delta Station during the past two years have ranged from fundamental studies of marsh ecology by Love (55) through studies on ethology of marsh and lake nesting waterfowl by Nice (64) and by Collias (17), and investigation of social parasitism by Weller (88) to studies designed to perfect and apply novel research techniques. Among the latter, one of greatest significance is that applying the use of fluoroscopic techniques to determine the amount of shot carried by living waterfowl and through this the hunting pressure on different species and stocks (31,34). Very important contributions to the conceptual bases of waterfowl management have been the idea of population tradition by Hochbaum and of the importance of reproductive persistence by Sowles (75).

The biological staff of the Canadian Wildlife Service has carried out several important studies of waterfowl biology, among them research on the breeding biology of the blue goose by Cooch (18), of the Canada goose by Munro (64), of the greater snow goose by Lemieux (54), the murre (87) and snipe by Tuck and the trumpeter swan by Mackay. Unfortunately, only short papers on collateral aspects of these studies have been published, and the important discoveries remain buried in departmental files.

Similar studies of the Barrows goldeneye and of the bufflehead are in progress in British Columbia and of the black duck in the Maritimes. The publication of the results of all these researches will equip us with an unparalleled body of data upon which to develop our philosophy and practise of waterfowl conservation.

Big game

Almost every province in which big game species are of importance is conducting some sort of investigation on this group. For the most part these are designed merely to provide local information required for immediate management application and cannot be expected to make important contributions at the conceptual level.

By far the most ambitious study so far attempted has been the co-operative research on the barren-ground caribou. Field staffs of the Canadian Wildlife Service

and the appropriate departments of the Provinces of Alberta, Saskatchewan, and Manitoba have united their efforts in an attempt to determine causes of the serious collapse in the population. Recent research on the destructive forces acting upon the barren-ground caribou has included studies of the influence of wind chill on the new born (19, 46), an examination of diseases and parasites, as well as the determination of constants that will permit interpretation of the physiological state of the individual. More is now known about the biology of this species than of any other wild ungulate except the smaller American deer *(Odocoileus spp)*. Some results have been published (3, 5, 30, 51) but it is to be hoped that an integrative monograph will appear soon bringing the entire body of research data together.

There have been three important studies on moose in Canada, namely: those of Pimlott in Newfoundland (69), Peterson in Ontario (68) and Hatter in British Columbia (47). Each contributed valuable data that have been incorporated into management in the region concerned. None of these, however, proceeded to explore the more fundamental areas of biology of large ungulates that can lead to an understanding of the behaviour of a population. The research by Ritcey and Edwards on a single population of moose in British Columbia seeks to proceed further into the fundamentals. The publication of their results is awaited with interest.

Deer have been the subject of inquiries into their distribution and abundance in almost all parts of their range. The long series of researches by Cowan, Wood, Kitts (1, 2, 24, 25, 26, 52) and their associates have proceeded further with the elucidation of the fundamental biological characteristics of this genus, *Odocoileus*, than any other Canadian wildlife species. Studies have included measurements of such constants as blood chemistry and haemotology, body temperature, nutritional requirements, growth, and the characteristics of aging. They are proceeding into the determinations of the bioenergetics and the capacities for thermal adjustment possessed by different racial stocks. Detailed studies of reproduction in the white-tailed deer have been completed in Ontario (45).

Satisfactory field data are available for the musk ox, especially from the researches of J. Tener (85).

Investigations of elk, pronghorn, mountain goat, and bighorn are still at the most superficial level.

Marine mammals

Several of the marine mammals of Canadian and Arctic waters have been the subject of researches that sought information on the important management characteristics of stock size (57), distribution, movements, reproduction and replacement, food sources, and the human impact (70). Excellent studies of this nature have been completed by Fisher on the harbor seal of the Pacific coast and the harp seal of Newfoundland and adjacent areas (41). Mansfield has studied the Atlantic walrus (61) and McLaren the bearded seal (56). There is an intensive study in progress of the pelagic phase of the life of the northern fur seal to provide data essential to the framing of a new international agreement for the conservation of this species.

Much less is known about our whales but some work is in progress on beluga, narwhal and pilot whales that will provide the background for the conservation and wise use of these species.

Fur Bearers

Considering the abundance of small carnivores in Canada, and their importance to the fur industry, it is surprising that there have been so few studies that can be referred to as research. Canadian biologists did some successful early work on reproduction in the marten and brought to light its peculiarity of delayed implantation. They have since conducted studies of mobility (29), age characteristics (De Vos unpublished), food habits (22), and relative organ sizes (28), but have largely neglected the interesting and important opportunities presented by these species. This is particularly unfortunate in view of the possibilities of elucidating the over-all problem of population regulation that can be derived from study of species that are at the second position in the food chain.

While the fur bearing carnivores have been neglected, the rodents have been the subject of much research. Muskrats have been studied in detail and over a wide latitudinal range by Stevens (78), McLeod (58,59), Olsen (66), Musfeldt (63), and others; and a useful body of data are now available, especially on reproduction and on diseases and parasites.

The beaver also has been studied in detail, with excellent basic data now available upon some physiological constants (77, 52, *et al)*, growth, change in organ weight, nutritional requirements (27), diseases (4, 65) and wild feed utilization. Here, as with several other wildlife species, we now know the main features influencing the rise and fall of populations and have acquired a great deal of information on the practical aspects of encouragement of depressed populations. An understanding of the mechanics of depression, and the ability to forecast population behavior still escape us.

Parasites and Diseases

Canadian biologists have been active in this area of wildlife research, and their contributions have been important. Inasmuch as disease, in the larger sense, constitutes one of the most important limitations on the size of populations of animals, the importance of discovering and understanding the diseases of wildlife species is obvious.

There is the further importance that wildlife is frequently involved in the transmission of disease to man and to domestic livestock or in the distribution of parasites damaging the human food animals.

Studies of parasites of wildlife species have been undertaken over a long period of years by the Institute of Parasitology at MacDonald College and by Fallis and his associates in the Ontario Research Foundation (15, 36, 37). Other centres of this type of research have been active at the University of Manitoba (McLeod), at the University of British Columbia (Adams, *et al*), and at the Arctic Unit of the Fisheries Research Board of Canada (Fisher, Scott).

The Health of Animals Laboratories of the Canada Department of Agriculture have become increasingly active in studies of wildlife disease (81), and more recently the biologists of the Canadian Wildlife Service (4, 43, 44), of the Newfoundland Department of Fish and Game (67), and of the Manitoba Game and Fisheries Branch (12) have been contributing. The involvement of trace-element deficiencies in moose mortality in Nova Scotia has been subject to careful scrutiny by Benson *et al* (6, 10).

The study of wildlife disease continues to be one of the most fruitful and potentially important areas for research. As yet we have only the most superficial knowledge of the parasites and diseases of wild animal species and know almost nothing about the epizootology of disease in wildlife. Discoveries in this area are a vital prerequisite to the final elucidation of the mechanisms underlying the quantitative behaviour of animal populations.

Wildlife Damage

The burgeoning demands of human populations upon the space, plants, and animals of Canada inevitably lead to increasing conflicts with the native fauna. If we are to continue to encourage the largest possible populations of wildlife to exist along with us to the great enrichment of our environment, it becomes important to develop techniques that can ameliorate the damage that may occur to the crops, livestock, and persons of those that share the use of wildlife habitat.

This is a large and complex field. At its simplest it involves discouraging attacks upon domestic livestock by predatory animals. An important area of conflict arises with the increase of depredations on grain crops by migrating waterfowl, of orchard damage by deer, damage to rangeland by elk, and to gardens and crops by a host of small rodents and insectivores.

By far the most vexing problems to be solved are those of waterfowl damage to crops (11) and of rodent damage to forest seed and young trees. As yet our attacks on these problems have been prosaic and the results do not measure up to the needs. This is an area where the research association of the chemist or physicist, and the biologist can be expected to yield useful results (84). It remains as one of the most important areas for advance. Failure to solve the problems by techniques that discourage damage without eliminating the animals will lead to the destruction of valuable and interesting wildlife.

Discussion

Under primitive conditions wildlife in Canada controlled the distribution of the human population and over most areas it is unlikely that the use by man was a critical factor in the maintenance of wildlife stocks. The increasing control of our environment that has been the theme of human progress through the last two centuries has placed man in the dominant position. Either directly or indirectly, human activities may now exert controlling influence on a large proportion of the stocks of wildlife species. When supply at the species level far exceeded demand, management was unnecessary. However, the closer supply and demand have come together, the greater the complexity of the task of management, and the more detailed the information required to maintain the resource. Thus in Canada the task of research is never done.

It must be realized also that the seeking and interpreting of ever more refined and sensitive information demand steady improvement in the quality of the researcher. The amateur naturalist of enthusiasm and keen observation half a century ago possessed all the background necessary to explore and describe the broad outlines of our wildlife circumstances, to map distributions, and describe animal forms. The present day demand for penetrating research into bioenergetics, epizootology, ethology, and auto-regulation of animal populations requires research workers who not only possess the natural enthusiasm and aptitudes of the naturalist, but also have years of disciplined experience in mathematics, chemistry, and biology, and the

advantage of rigorous training in the philosophy and method of research.

One of the real problems in any management-oriented research organization in a rapidly changing era is that research needs may quickly outstrip the ability of the staff to frame the questions and devise techniques for seeking the answers. The more penetrating the questions to be answered, the more intelligent, ingenious, and skilled must be the seeker, the more complex the research staff must become, and the better the equipment, environment, and administration.

The intellectual demands on research workers in wildlife have greatly increased, and as men of the desired calibre are limited and in high demand throughout science, the opportunities and rewards must be adequate to attract and hold the best men and women available.

There has been a lack of realization of these facts on this continent. Few provincial wildlife organizations have sought progressively more highly skilled research staffs. Rather, they have continued to employ partially trained biologists and instead of encouraging the pursuit of the more refined knowledge required to improve our understanding, they have used increased staff for the sterile task of repetitive regional pursuit of answers already known.

Operational information is as necessary for the resource manager as stock taking and accounting for the man of commerce, but gathering such essential data is not research. The use of highly trained research men for the gathering of operational information is just as wasteful as trying to use men without the requisite imagination training, and experience to fulfill the research needs of today. It is highly desirable to maintain separate biological staffs for each purpose. Up to this point the wildlife resource has not been adequately supported by research, consequently the information required for the management of the resource in increasingly complex situations is often not available.

Conclusions

This review of wildlife research in Canada reveals that we have done a creditable job of the preliminary task of exploration. We now know the overall distribution of our wildlife species and we have a general idea of the abundance of each.

We have made a good beginning in the determination of the ecological requirements for survival of the most important species. Some kinds of animals have, because of their particular importance, for one reason or another, or because they have absorbed the attention of some one researcher over a period of years, been the subject of more penetrating research. The barren-ground caribou, moose, black-tailed deer, muskrat, beaver, sooty grouse, and the waterfowl have thus yielded data of use specifically in their immediate management and details that have contributed to our general understanding of ecology, population behavior, and management.

We must continue and expand research at all levels, but six areas are of special importance.

The first area for intensified research is in support of the development of management techniques. It includes problems of immediate practical importance, especially the improvement of censuses and of methods for repelling animals causing damage.

The second area is centred around the question of self regulation of animal numbers. It involves exploration of the intrinsic mechanisms that permit some populations to equate their numbers with environmental capability. It also entails study of those species, less sensitively adapted to their environment, which demonstrate the more dramatic cyclic population response.

Research in the third area, allied to the second, involves determination of the extent of animal parasitism and disease and its operation as a density dependent mortality factor.

The fourth area that appears to demand greatly increased research effort is that of the physiological and functional mechanisms of adaptation.

As a fifth area, I suggest the operation of hunting pressures and how they are affected by regulations on the one hand and socio-economic forces on the other.

Finally, the economics of land use for wildlife demands continuous imaginative enquiry.

Such research will permit us to build a sound basis of understanding upon which to develop the more refined management that will be demanded by the burgeoning populations of the future.

The research needs indicated are complex and will demand for their solution groups of workers provided with advanced training in research and possessed of unusual imagination and persistence.

If we are to meet the demands it is imperative that those responsible for the staffing and administration of the departments of government, and of the private and public organizations by whom the research will be done, appreciate the demands of research of the type indicated. Good staff, adequate financing, effort continued over long enough periods of time to permit the derivation of valid conclusions, and enlightened leadership and encouragement will be increasingly demanded.

References

[1] Bandy, P.J., I. McT Cowan, W.D. Kitts, and A.J. Wood. 1956. A method for the assessment of the nutritional status of wild ungulates. Canad. Journ. Zool. 34: 48–52.

[2] Bandy, P.J., W.D. Kitts, A.J. Wood and I. McT. Cowan. 1957. The effect of age and plane of nutrition on the blood chemistry of the Columbian Blacktailed deer. Canad. Journ. Zool. 35: 283–289.

[3] Banfield, A.W.E. 1950. The barren ground caribou. Canadian Wildl. Serv. Mimeo. 275 pp.

[4] Banfield, A.W.F. 1954. Tularemia in beaver and muskrats, Waterton Lake National Park, Alberta, 1952-53. Canad. Journ. Zool.

[5] Banfield, A.W.F. 1954. Preliminary investigation of the barren ground caribou. Canad. Wildl. Mgmt. Bull. 10a, 79 pp; 10b, 112 pp.

[6] Beeler, D.A., D.A. Benson, and W.M. Langelle. 1959. Mineral analyses of livers and kidneys of moose *(Alces americans)*. Journ. Wildl. Mgmt. 23: 356–358.

[7] Bendell, J.F. 1955. Age, molt and weight characteristics of Blue Grouse. Condor, 57: 354–361.

[8] Bendell, J.F. 1955. Disease as a control of a population of Blue Grouse, *Dendragopus obscurus fuliginosus* (Ridgway). Canad. Journ. Zool. *33:* 195–223.

[9] Bendell, J.F. 1959. Food as a control of a population of white-footed mice, *Peromyscus leucopus noveboracensis* (Fischer). Canad. Journ. Zool. *37:* 173–209.

[10] Benson, D.A. 1958. Moose sickness in Nova Scotia, Canad. Journ. Comp. Med. and Vet. Sci. *22:* 244–248; 282–286.

[11] Bossenmaier, E.F. and W.H. Marshall 1958. Field feeding by waterfowl in southeastern Manitoba. Wildlife Monogr. No. 1: 1–32.

[12] Bossenmaier, E.F. 1959. Waterfowl sickness diagnosis in Minnesota, North Dakota, and Manitoba. Journ. Wildl. Mgmt. *23*(1): 113–115.

[13] Chitty, D. and C. Elton. 1937. Canadian Arctic Wildlife Enquiry 1935–36. Journ. Anim. Ecol. *6:* 368–385.

[14] Chitty, D. 1960. Population processes in the vole and their relevance to general theory. Canad. Journ. Zool. *38:* 99–114.

[15] Clarke, C.H.D. 1936. Fluctuations in numbers of ruffed grouse, *Bonasa umbellus* Linni, with special reference to Ontario. Univ. Toronto Studies, Biol. Ser. No. 41: 1–118.

[16] Clarke, S.E., J.A. Campbell and J.B. Campbell. 1942. An ecological and grazing capacity study of the native grass pastures in southern Alberta, Saskatchewan and Manitoba. Tech. Bull. 44, Canada Dept. Agric. 31 pp.

[17] Collias, E.C. and N.E. Collias. 1957. Response of chicks of the Franklin's gull to parental bill colour. Auk *74;* 371–375.

[18] Cooch, F.G. 1958. The breeding biology and management of the blue goose. Unpublished Ph.D. thesis, Cornell University, 235 pp.

[19] Cottle, W. 1959. Thermal responses and cold tolerance of young caribou calves. Unpubl. Report, Canad. Wildl. Serv., Ottawa.

[20] Cowan, I. McT. 1938. The fur trade and the fur cycle, 1825–1857. B.C. Hist. Quart., 30 pp.

[21] Cowan, I. McT. 1944. Report of wildlife studies in Jasper, Banff and Yoho National Parks, 1944. Canad. Wildl. Service. Mimeo. 53 pp.

[22] Cowan, I. McT. and R.H. Mackay. 1950. Food habits of the Marten (Martes americana) in the Rocky Mountain region of Canada. Canad. Field Nat. *64:* 100–104.

[23] Cowan, I. McT., W.S. Hoar, and J. Hatter. 1950. The effect of forest succession upon the quantity and upon the nutritive values of woody plants used as food by moose. Canad. Journ. Res. D *28:* 249–271.

[24] Cowan, I. McT. and A.J. Wood. 1955. The growth rate of the black-tailed deer. Journ. Wildl. Mgmt. *19:* 331–335.

[25] Cowan, I. McT. 1956. The black-tailed deer, in, Taylor, W.P., *et al* "The Deer of North America". Stackpole Co., Harrisburg, Pa. pp. 523–617.

[26] Cowan, I. McT. A.J. Wood, and W.D. Kitts. 1957. Feed requirements of deer, beaver, bear and mink for growth and maintenance. Trans. 22nd N. A Amer. Wildl. Conf. 1957: 179–188.

[27] Currier, A., W.D. Kitts and I. McT. Cowan, 1960. Cellulose digestion in the beaver *(Castor canadensis)*. Canad. Journ. Zool. *38*. In press.

[28] Daniels, M., A.J. Wood and I. McT. Cowan. 1960. Organ weight-body weight relationships in the mustelidae. In preparation.

[29] de Vos, A., A.T. Cringan, J.K. Reynolds and H.G. Lumsden. 1959. Biological investigations of traplines in northern Ontario. Ont. Dept. Lands & Forests, Tech. Bull., Wildlife Ser. No. 8: 1–62.

[30] de Vos, A. 1960 Behaviour of barren ground caribou on their calving grounds. Journ. Wildl. Mgmt. *24:* 250–258.

[31] Edwards, R.Y. 1954. Comparison of an aerial and ground census of moose. Journ. Wildl. Mgmt. 18: 403.

[32] Edwards, R.Y. 1956. Snow depths and ungulates. Journ. Wildl. Mgmt. 20: 159.

[33] Elder, W.H. 1950. Measurements of hunting pressure in waterfowl by means of X-ray. Trans. 15th N. Amer. Wildl. Conf.: 490–504.

[34] Elder, W.H. 1955. Fluoroscopic measures of hunting pressure in Europe and North America. Trans. 20th N. Amer. Wildl. Conf.: 298–322.

[35] Elton, C. and M. Nicholson. 1942. The ten year cycle in numbers of lynx in Canada. Journ. Anim. Ecol. *11:* 215–244.

[36] Fallis, A.M., D.M. Davies, and M. Vickers. 1951. Life history of *Leucocytozoan simondi* Mathis and Leger in natural and experimental infections and blood changes produced in the avian host. Canad. Journ. Zool. *24:* 305–328.

[37] Fallis, A.M. and G.F. Bennett. 1958. Transmission of *Leucocytozoan bonase* Clarke to ruffed grouse *(Bonasa unubellus L.)* by the black fly *Simuluim latipes* Mg and S. *aureum* Fries. Canad. Journ. Zool. *36:* 533–539.

[38] Fisher, H.D. 1955. Utilization of Atlantic Harp seal populations. Trans. 20th N. Amer. Wildl. Conf.: 507–518.

[39] Fuller, W.A. 1959. The horns and teeth as indicators of age in bison. Journ. Wildl. Mgmt. *23:* 432–344.

[40] Fuller, W.A. 1952. Aerial beaver surveys, Mackenzie District. 20 pp. unpubl. report, Canad. Wildl. Serv.

[41] Fuller, W.A., and N.S. Novakowski. 1955. Wolf control operations, Wood Buffalo National Park, 1951–52. Canad. Wildl. Serv., Wildl. Mgmt. Bull., Ser. 1, No. 11: 19.

[42] Gavin, A. 1947. Birds of Perry River District, Northwest Territories. Wilson Bull. *59:* 195–203.

[43] Gibbs, H. 1958. Report on disease investigation of barren ground caribou, July, 1957 and August, 1958. Unpubl. Report, Canad. Wildl. Serv.

[44] Gibbs, H.C. and J.S. Tener. 1958. On some helminth parasites collected from the musk ox *(Ovibos moschatus)* in the Thelon Game Sanctuary, Northwest Territories. Canad. Journ. Zool.

[45] Gibson, D.E. 1960. The ovary as an indicator of reproductive history in the white-tailed deer. In preparation.

[46] Hart, J.S. and C.P. Lentz. 1960. The effect of wind and moisture on heat loss through the fur of newborn caribou. Canad. Journ. Zool. *38:* 679–688.

[47] Hatter, J. 1950. The moose of British Columbia, Unpubl. thesis, Wash. State Coll., 356 pp.

[48] Hochbaum, H.A. 1944. The canvasback on a Prairie Marsh. Amer. Wildl. Inst., Wash., D.C.

[49] Hochbaum, H.A. 1947. The effect of concentrated hunting pressure on waterfowl breeding stock. Trans. 12th N. Amer. Wildl. Conf.: 53–62.

[50] Hochbaum, H.A. 1955. Travels and traditions of waterfowl. Univ. Min. Press, Minneapolis.

[51] Kelsall, J.P. 1957. Continued barren ground caribou studies. Canad. Wildl. Serv., Wildl. Mgmt. Bull. No. 12.

[52] Kitts, W.D., M.C. Robertson, B. Stephenson and I. McT. Cowan. 1958. The normal blood chemistry of the beaver *(Castor canadensis).* A. Packed cell volume, sedimentation rate, hemoglobin, erythrocyte diameter, and blood cell counts. Canad. Journ. Zool. *36:* 279–283.

[53] Lalzoffsky, N.A. and J.F.A. Sprent. 1952. Tularaemia among beaver and muskrat in Ontario. Canad. Journ. Med. Sci. *30:* 250–255.

[54] Lemieux, Louis, Histoire naturelle et aménagement de la grande oie blanche *Chen hyperborea atlantica.* Naturaliste Canadien, 86, 133–192 (1959).

[55] Löve, A. and D. Löve. 1954. Vegetation of a prairie marsh. Bull. Torrey Bot. Club *81:* 16–34.

[56] MacLulich, D.A. 1936. Sunspots and the abundance of animals. Journ. Roy. Astron. Soc. Canada, 1936: 215–246.

[57] McLaren, H.D. 1958. Some aspects of growth and reproduction of the bearded seal, *Erignathus barbatus* (Erxleben). Journ. Fish. Res. Bd. Canada *15:* 219–227

[58] McLaren, I.A. 1958. The economics of seals in the eastern Canadian Arctic. Fish. Res. Bd. Canada Circular 1: 1–94.

[59] McLeod, J.A. 1950. A consideration of muskrat populations and population trends in Manitoba. Trans. Roy. Soc. Canada *44,* Ser. 3: 69–79.

[60] McLeod, J.A. and G.F. Bonder. 1952. Studies on the biology of the muskrat in Manitoba. Part 1. Oestrus cycle and breeding season. Canad. Journ. Zool. *30:* 243–253.

[61] Manning, T.H. 1960. The relationship of the Peary and barren ground caribou. Arctic Inst. of N.A. Tech. Paper No. 4: 52 pp.

[62] Mansfield, A.W. 1959. The walrus in the Canadian Arctic. Fish. Res. Bd. Canada. Circular 2: 1–13.

[63] Mansfield, A.W. and H.D. Fisher. 1960. Age determination in the Harbour Seal, *Phoca vitulina* L. Nature, *186:* 92–93.

[64] Munro, D.A. Factors affecting reproduction of the Canada goose *Branta Canadensis.* Proc. XIIth Internat. Ornith. Congr. Helsinki. 1959 pp. 542–556

[65] Musfeldt, I. 1951. Diseases and Parasites of the Muskrat *(Ondatro zibethiea)* in British Columbia. Canad. Journ. Zool. *29:* 188–214

[66] Nice, M.M. 1953. Some experiences in imprinting ducklings. Condor, *55:* 33–37.

[67] Nash, J.B. 1951. An investigation of some problems of ecology of the beaver in Northern Manitoba. M.Sc. thesis, Univ. Manitoba. Mimeo. 64 pp.

[68] Olsen, P.F. 1959. Dental patterns as age indicators in muskrats. Journ. Wildl. Mgmt. *23:* 228–231.

[69] Peters, S.S. and J.M. King. 1959. Newfoundland caribou disease investigations, 1958. Mimeo. 55 pp.

[70] Peterson, R.L. 1955. North American moose. Univ. Toronto Press. 280 pp.

[71] Pimlott, D.H. 1959. Reproduction and productivity of Newfoundland moose. Journ. Wildl. Mgmt. *23:* 281–401.

[72] Scott, D.M. and H.D. Fisher. 1958. Incidence of the Ascarid *Porrocaecum decipiens* in the stomachs of three species of seals along the southern Canadian Atlantic mainland. Journ. Fish. Res. Bd. Canada *15:* 495–516.

[73] Sergeant, D.E. 1959. Age determination in Odontocete whales from dentinal growth layers. Norwegian Whaling Gaz. 1959 (6): 273–288.

[74] Sergeant, D.E. 1959. Studies on the sustainable catch of harp seals in the western North Atlantic. Fish. Res. Bd. Canada Circular 4: 1–37.

[75] Sergeant, D.E. and D.H. Pimlott. 1959. Age determination in moose from sectioned incisor teeth. Journ. Wildl. Mgmt. 23: 315–321.

[76] Soper, J.D. 1930. The blue goose. Northwest Territories and Yukon Branch Dept. of Interior, Ottawa, 66 pp.

[77] Sowles, L.K. 1949. A preliminary report on renesting in waterfowl. Trans. 14th N. Amer. Wildl. Conf.: 260–275.

[78] Sowles, L.K. 1955. Prairie ducks. Wildl. Mgmt. Inst., Wash., D.C.

[79] Stephenson, A.B., W.D. Kitts, A.J. Wood and I McT. Cowan. 1959. The normal blood chemistry of the beaver *(Castor candensis)*. B. Blood glucose, total protein, albumin, globulin, fibrinogen, creatinine, cholesterol, and volatile fatty acids. Canad. Journ. Zool. *37:* 9–14.

[80] Stevens, W.E. 1953. The northwestern muskrat of the Mackenzie Delta, North West Territories, 1947–48. Canad. Wildl. Serv., Wildl. Mgmt. Bull. Ser. 1, No. 8: 40.

[81] Stokes, A.W. 1952. Pheasant survival studies on Peter Island, Ontario, 1946–50. Trans. 17th N. Amer. Wildl. Conf., pp. 285–293.

[82] Stokes, A.W. 1954. Population studies of the ring-necked pheasants on Pelee Island, Ontario, Ont. Dept. Lands & For., Tech. Bull. No. 4, 154 pp.

[83] Sweatman, G.K. 1952. Distribution and incidence of *Echinococcus granulosus* in man and other animals with reference to Canada. Canad. Journ. Public Health, *32:* 480–486.

[84] Taggart, C.I. and Bossenmeier, E.F. 1960. Experiments to determine feasibility of counting deer by air photo interpretation. Mimeo. 10 pp.

[85] Tener, J.S. 1954. A preliminary study of the musk oxen of Fosheim Peninsula, Ellesmere Island, N.W.T. Canad. Wildl. Serv., Wildl. Mgmt. Bull. Ser. 1, No. 9: 35 pp.

[86] Thiessen, G.J. *et al.* 1957. Acoustic irritation threshold of Peking ducks and other domestic and wild fowl. Journ. Acoust. Soc. Amer. 1957.

[87] Tuck, L.M. The Murres, – their distribution, populations and Biology. Canad. Wildl. Service Monograph No. 1. Dept. Northern Affairs and National Resources, Ottawa, 1961 (in press).

[88] Weller, M.W. 1959. Parasitic egg laying in the redhead *(Aythya americana)* and other North American Anatidae. Ecol. Monog. *29:* 333–365.

[89] Wright, B. 1948. Survival of the Northeastern Panther *(Felis concolor)* in New Brunswick. Journ. Mammal. *29:* 235–246.

93452–59½

The Organization of Wildlife and Fisheries Research in Canada

J. R. Dymond
Ontario Department of Lands and Forests

The organization of wildlife and fisheries research in Canada needs to be improved.

The extent of support received by various organizations concerned with research in Canada varies, and the total support is quite inadequate to meet the need if the management of our wildlife and fisheries resources is to be as effective as it should be.

The amount and nature of research being carried out by federal and provincial government agencies are largely determined by their administrative responsibilities and their financial resources.

Research having direct application to the management of resources should be carried out as closely as possible in relation to its point of application, but much of the necessary research cannot be undertaken by the less wealthy provinces.

To overcome difficulties inherent in this situation, close liaison should be maintained between agencies doing research having relation to the conservation of resources.

An important problem in the organization of research is in determining what categories of research are better carried out directly by administration and service departments of government or by a board, as in the case of the Fisheries Research Board. This problem should be studied by a committee or commission of persons having technical knowledge of and experience in actual research.

Universities are not being enabled to carry out adequately their two indispensable functions in the promotion of research, viz., basic research and the training of research personnel. Therefore the requirements of universities must receive immediate attention if the research needs of the country are to be met adequately.

Since the most effective management of renewable resources requires a knowledge of the interrelationships between plants and animals and between them and their non-living environment, the preservation of nature reserves where ecological studies may be carried out is a necessity. Adequate provision must be made for setting aside, preserving, and studying samples of all types of ecological communities found in Canada.

A common weakness of research is a lack of understanding between administrators and research personnel. Onus for this situation must be shared by both parties, but the situation should be rectified if the most effective results are to accrue from a research program and the application of its results in management. An important element in bringing about understanding between administrators and research personnel is much more time spent in discussion.

Related to the problems outlined above is that of the maintenance of high scientific morale in government research organizations.

There is urgent need for active liaison not only between federal and provincial research agencies, but between these and academic institutions.

Because of the great complexity of plant and animal relationships and the difficulty of conducting controlled experiments in the field, biological research is unusually difficult. This situation is not generally understood. As a result biological research does not receive support commensurate with the difficulty and range of problems involved in the management of living resources.

Arising from a lack of understanding of biology is its failure to attract a sufficient number of first class students prepared to undertake training as research workers. The result is that there exists an inadequate supply of highly qualified research workers. Efforts must therefore be made to bring about a better understanding of the nature and importance of biological research and of its problems.

In wildlife and fisheries conservation, the function of research is to secure the facts necessary for effective management.

The first conclusion reached when one makes a study of the organization and support of wildlife and fisheries research in Canada at the present time is that the research effort is totally inadequate to meet the need for providing, within a reasonable time, the information necessary for the most effective management.

The kinds of information needed for effective wildlife and fisheries conservation are:

1. *Biological.* This involves an understanding of the factors which determine the size and other characteristics of the populations of fish, mammals, birds, and other animals constituting our wildlife and fisheries resources and how and to what extent populations can be controlled.
2. *Economic.* There is need for research to evaluate our wildlife and fisheries resources and to provide information on the economics of production, management, and utilization. In evaluating these resources their recreational and esthetic values must not be overlooked.
3. *Sociological.* The sociological implications of certain management techniques may be important in determining management policies.

Since economic and sociological implications will be dealt with in other papers, it is not proposed to discuss them further.

The factors involved in an adequate and effective program of research include:

1. A competent staff,
2. An effective organizational structure,
3. Adequate financial support.

These factors are not independent of one another; each may have a determining effect on the others.

Most research related to wildlife and fisheries conservation is done either by governments or by universities, although some is done by other agencies. It is usually considered to be the function of universities to do basic research and of governments to do applied research. Such generalizations, however, are subject to exceptions.

Federal Government Research

The extent to which research is undertaken by the federal government in fisheries and wildlife is, in the main, related to its constitutional responsibility in the two fields. Responsibility for fisheries was given to the Federal Government under the British North America Act. However, by agreement, some responsibility has been given to British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario for freshwater fisheries, and to Quebec for all fisheries including marine, with the federal government retaining full responsibility in other areas.

As the B.N.A. Act is interpreted, wildlife was given to the provinces as a civil and property right. The Federal Government, therefore, has administrative responsibility for wildlife only on federal lands, which consist largely of National Parks. Under the B.N.A. Act, matters which are the subject of international treaties are the responsibility of the federal government. In the wildlife field this includes migratory birds.

There is some federal responsibility in game management in the Northwest Territories because of the present transitional stage of their legislative development.

While research in any field may be carried out by either federal or provincial governments, administrative responsibility imposes more of an obligation in matters for which a government has such responsibility.

Important federal government research agencies engaged in fisheries and wildlife research are the Fisheries Research Board of Canada, the Fish Culture Development Branch of the Department of Fisheries and the Canadian Wildlife Service.

The Fisheries Research Board consists of nine members of university staffs, seven representatives of the fishing industry, and one member of the Department of Fisheries. The Board operates under the Minister of Fisheries. Its precursor was formed in 1899, and for the first twenty-one years of its existence, the Chairman of the Board was the Commissioner of Fisheries. Then for 27 years the Chairman was a university scientist who gave only part-time to directing the operations of the Board. For the next six years there was a part-time Chairman and a Vice-Chairman. During the last seven years there has been a full-time paid Chairman. Such an appointment became necessary with the great expansion in the Board's research program and in the number of its staff, which at present includes 161 scientists, 245 technicians, and 111 administrative and clerical.

The Fish Culture Development Branch has as its chief function the application of research findings in the management of fisheries under the control of the federal Department of Fisheries. However, it carries out some research on its own initiative. Its staff consists of 22 biologists, 15 engineers and 45 technicians.

The Canadian Wildlife Service is an integral part of the National Parks Branch of the Department of Northern Affairs and National Resources. This is in contrast to the situation in fisheries where research is under a Board.

Another difference between fisheries and wildlife research by the federal government is that wildlife research was not formally organized until 1947. Some wildlife studies had, of course, been carried on sub-

sequent to the signing of the Migratory Birds Treaty in 1916, and more particularly since the late 1930's.

Canada is not unusual in the fact that wildlife research was late in being organized as compared with fisheries. This appears to have been the case practically everywhere else.

The present staff of the Canadian Wildlife Service includes 39 scientists, 16 technicians and technical officers, some seasonal, 44 administrative and clerical, and six wardens.

The National Research Council has two distinct functions: (1) operation of its own laboratories, and (2) support of university research.

In N.R.C. laboratories the Division of Applied Biology is engaged in an active project on the cold physiology of warm-blooded animals, including both wildlife species and man.

Support of university research takes the form of post doctorate fellowships, grants in aid of travel, bursaries, scholarships to graduate students, and assisted research grants to professors under which undergraduate or graduate students may be employed. These grants are not contracts, as the problems are suggested by the professors. Basically, the awards are made to individuals who have a record of research productivity rather than to specific types of projects. University research related to wildlife and fisheries is supported in this way and receives the same consideration as research in any other fields.

During 1960-61 funds available from the National Research Council for all forms of university research, including scholarships, were about $9.2 million. The total of assisted research grants was about $3.6 million and of that amount about $965,000 was in support of biological work. Grants directly referable to research on wildlife and fisheries total $135,000.

Provincial Government Research

Every provincial government is carrying on research in wildlife and/or fisheries. Some provinces have only recently undertaken fisheries and wildlife research, while a few have relatively large and well organized programs. There is also a wide diversity in the way research is organized and conducted in the different provinces.

In Ontario and Manitoba, research is carried on physically within the agency having administrative responsibility for management. In British Columbia and Saskatchewan, most wildlife and fisheries research is carried on in close association with the provincial university department of biology or zoology. Fisheries research in Quebec is closely associated with the University of Montreal and in Alberta with the University of Alberta. In Newfoundland close cooperation exists between the University and the Wildlife Division of the Department of Mines and Resources.

There will always be great differences in the extent to which provinces can undertake research. While it is necessary that, so far as possible, research should be as close as possible to the ultimate beneficiary, the less wealthy provinces will have to depend in varying degrees on the results of research carried out by other provinces and by the Federal Government. This situation necessitates close liaison between all the provinces and with the federal government.

Research under International Agencies

Canada has entered into eight international treaties for the conservation of fish and wildlife. Under these the following Commissions have been established:

International Pacific Salmon Fisheries Commission,
International North Pacific Fisheries Commission,
International Pacific Halibut Commission,
International Commission for the Northwest Atlantic Fisheries,
Great Lakes Fishery Commission,
International Whaling Commission, and North Pacific Fur Seal Commission.

Under the Migratory Birds Treaty, research in Canada is carried on by the Canadian Wildlife Service.

Under the Commissions for the conservation of halibut and Fraser River pink and sockeye salmon, Canada contributes funds to the Commissions which carry out research. In the more recently negotiated North Pacific, North Atlantic, and Great Lakes agreements, research is carried out by organizations of the participating countries on a basis arranged through discussion.

In research on fur seals, Canada accepts responsibility for certain segments of an over-all research program adopted by the Commission. In this respect the arrangement is comparable to that of the North Pacific, North Atlantic and Great Lakes fisheries.

Under the International Whaling Convention, research is carried out by Canadian scientists in connection with whaling carried on by Canadian ships.

Under most of these international conventions and all of the ones recently negotiated, the policy is to have research carried out by national organizations as arranged by negotiation rather than through a supranational body. This principle probably has validity also for research agreements between provinces and between the federal and provincial governments.

What Type of Organization of Government Research is Most Effective?

There is not likely to be complete agreement on this point. Each type of organization has its advantages and disadvantages.

There is a good deal of evidence to support the opinion that there are many advantages in having research independent of the administrative and service aspects of government. This is particularly true if the research group is small. One danger to which a research group closely associated with administration is exposed is that they may become mere *trouble shooters*. An advantage of research organized under a Board is that there is brought to bear on the research problems involved, the knowledge and experience of several scientists of ability and long experience in science and research. A danger is the possible lack of close integration between research and management. This is the problem of communication.

Association of some government research agencies with a university makes possible frequent consultation with other research personnel in planning and conducting research. It also assists in maintaining scientific morale. This is of extreme importance in the case of a small staff which may otherwise be forced to work under conditions and in an atmosphere completely foreign to that of scientific research. A disadvantage of such an arrangement is that it adds to the difficulty of communication between research and administrative staffs. However, it should be pointed out that existence under one roof does not guarantee adequate communication, nor does separation, even in different cities, prevent it.

Universities and Research

Universities promote research in two important ways: through the conduct of research and through the training of research personnel.

Basic Research. It has already been pointed out that it is one of the functions of universities to do basic research and of government to do applied research. Basic research is research carried out with the object of adding to our understanding of nature's laws; it may or may not be immediately applicable in management.

Leaders in every field of research agree that much more basic research is not only desirable but necessary in the interest of applied research. While this is not the only reason for basic research, it is the one with which we are chiefly concerned here.

While it is generally agreed that much more basic research is necessary and that such research is the special obligation of universities, our present methods of financing basic research are not well adapted to supporting or assuring an adequate program of this kind of research.

Training Research Personnel. Universities have been provided with reasonably adequate funds to employ staff and to provide classroom, laboratory, library, and other facilities to carry out the training of undergraduates, but quite inadequate provision has been made in the matter of staff, laboratory equipment, and other requirements involved in the training of graduate students in research.

Biological Field Stations are operated in connection with a number of universities. Some of these receive support, usually indirect, from provincial agencies. In some cases university personnel are accommodated in federal or provincial field stations.

Relation to Applied Research. Although the primary research function of universities is related to fundamental research, some universities assist applied fisheries and wildlife research directly or indirectly.

The Department of Entomology and Zoology of the Ontario Agricultural College has a wildlife and fish section which gives training in wildlife and fisheries management and research, and carries out a program of research in wildlife and fisheries.

Most other academic institutions in Canada support applied research in a variety of ways. These include providing facilities for provincial government research personnel or having staff members serve on committees which advise provincial government research organizations.

Need for Strengthening Canadian Graduate Schools. Since the first and most important requirement for a strong research program is an adequate number of competent research workers, the ability of universities to produce enough highly trained research personnel must receive the most careful consideration.

Dr. C.J. Mackenzie, at that time President of the National Research Council, said in 1949, speaking at the opening of new chemical laboratories at the University of Toronto, "From the national standpoint, it is most important that some way be found to increase and strengthen Canadian graduate school facilities to meet the demand for trained personnel." That need still exists.

While it is desirable that some graduate training be acquired outside Canada, the danger of having too many of our students go elsewhere for their training is that they may be permanently lost to the country.

University Research Institutes

The Institute of Fisheries, University of British Columbia, is a separate administrative unit forming part of the Faculty of Graduate Studies. Its function is to encourage research on problems related to fisheries.

The Institute is financed by contributions from the University, the provincial government, the National Research Council, industry, private endowments, and miscellaneous research grants.

The Institute of Parasitology, McGill University, is governed by a Joint Committee made up of members of the University, the National Research Council, and co-opts members of any government departments supporting or interested in particular projects. The Ins-

titute's major source of financial support is the National Research Council, although the University contributes and maintains the building and provides essential services.

While the Institute's researches have been on the important economic parasites of man and his domestic animals, attention has been given to the parasites of wildlife and both fresh-water and marine fishes. This work, however, is essentially fundamental rather than applied.

Institute for Northern Studies, University of Saskatchewan, stimulates and aids the acquisition of knowledge regarding the Canadian North. Its program includes biological investigations.

The Boreal Institute, University of Alberta, has as its objective the acquisition and dissemination of knowledge of the North through an information centre, through training and instruction, and through research.

Museums

Museums, both national and provincial, have contributed valuable information on the wildlife and fish fauna of Canada. Their chief contributions have been in systematics and distribution, but they have added to knowledge of the life history of many species.

A difficulty often experienced by research workers is in identifying many of the food items eaten by fish and wildlife or the parasites found in or on them. Unfortunately, there are too few zoologists competent to undertake the identification of many groups of animals. While such authorities are not confined to museums, this branch of zoology should find its most congenial home there.

Other Research Organizations

The Ontario Research Foundation has a Department of Parasitology which has carried out and is still engaged on research on the parasites of wildlife and fish. Some of these parasites profoundly affect the welfare of natural populations.

Northeastern Wildlife Station is operated co-operatively by the University of New Brunswick and the Wildlife Management Institute of Washington, D.C. The field program is also supported by the National Research Council, Canadian Industries Limited, New Brunswick Fish and Game Protective Association, and New Brunswick Department of Lands and Mines.

Delta Waterfowl Research Station, Delta, Manitoba, is sponsored by the North American Wildlife Foundation, an international group whose board is made up of Canadian and U.S. trustees. The station provides facilities for qualified biologists studying any phase of waterfowl or marsh biology. Fifty graduate students from universities in the United States, Canada, and England have used the results of research at Delta in connection with work toward their Ph.D. or Master's degrees.

Canadian Industries Ltd. (C.I.L.) supports wildlife research through research fellowships to Canadian postgraduate students and also through grants to enable fellowship holders to carry out field researches. Since the program was started in 1955, seventeen postgraduate students have been assisted through fellowships and grants.

Canadian National Sportsmen's Show. Funds in excess of $200,000 have been given over the past twelve years to promote research on wildlife and fisheries problems, largely through grants for the support of graduate students.

Arctic Institute encourages and co-ordinates research pertaining to Arctic and sub-Arctic regions.

Ducks Unlimited is essentially a management organization but it contributes to accumulation of knowledge of value in the broad field of wildlife and fisheries management, through wetlands surveys.

Ecological Research

This is an aspect of research, having an application to fisheries and wildlife conservation, which is not receiving the attention which its importance warrants.

The term ecology covers a wide variety of studies of the living relationships between plants and animals and between them and their environment. A knowledge of how the non-living as well as the living environment of each species of plant and animal affects it is necessary before the factors which control its abundance can be understood and, where possible, managed.

A feature of ecological research which has received scant attention in Canada is the provision for the maintenance of reserves for such studies. In Great Britain an extensive series of nature reserves has been set aside under an official agency known as the Nature Conservancy, and a program of ecological research has been undertaken on these reserves. The objective of this research is to provide the knowledge necessary for the most effective management of all the different kinds of land and water areas of the country and the plant and animal life which they support.

Everyone concerned with the promotion of wildlife and fisheries research should support the setting aside of an adequate number and variety of nature reserves.

Communication

Of the problems involved in the organization of research, none is more important than those covered by the term communication.

Research personnel and their directors must have a clear and accurate understanding of the needs which

their efforts must satisfy. Administrators require an equally clear and accurate understanding of the facts and principles discovered by research on which they must base effective management programs.

Reaching this mutual understanding is difficult for several reasons. One is the wide gap which often exists between the habits of mind of the research scientist and the administrator.

Another reason for failure through communication to reach mutual understanding is not spending enough time in discussion. The attitude that submissions, explanations, etc., must be limited to one page is fatal to accurate understanding. Adequate understanding of research needs and research findings often cannot be attained without considerable discussion. If the administrator hasn't time to obtain an adequate understanding as a basis for decisions which determine the success or failure of a research program, some other basis for reaching administrative decisions in this matter must be sought.

The employment in administrative posts of trained wildlife and fishery scientists with administrative ability is a valuable contribution to effective communication between research and administration. The resulting advantage of increased understanding is usually greater than the disadvantage of removing such persons from the research field.

It may be that one of the great weaknesses of research on this continent is that too many decisions affecting the welfare of research programs are made by administrators with no adequate understanding of research or of the factors necessary for its success. Responsibility for this situation must be shared. Too often scientists do not contribute as much as they should to the administrator's understanding of science and the scientist.

Wildlife and Fishery Societies and Conferences contribute to communication through discussion at their meetings.

At meetings of the Canadian Society of Wildlife and Fishery Biologists, scientists engaged in both research and management meet for the presentation and discussion of scientific papers. Since the membership of the Society includes biologists from federal and provincial government services and from universities from every part of Canada, its meetings provide excellent opportunities for communication.

The Canadian Committee on Freshwater Fisheries Research is an *ad hoc* national organization through which communication in the fisheries field is effected. Its meetings are attended by biologists from universities and government agencies from all parts of the country.

A Federal-Provincial Wildlife Conference convened annually by the Canadian Wildlife Service provides opportunity for exchange of information and ideas on wildlife. Problems of research as well as those of management are included in the proceedings of the Conference.

Among other committees and conferences which have been brought to my attention are a technical committee for caribou conservation which meets annually, an annual international antelope meeting, and an annual prairie wildlife habitat meeting. All of these are attended by research biologists. There are probably other similar meetings which meet regularly or on an *ad hoc* basis.

Publication is another method of communication.

Communication of the results of research is much more effective among scientists than between scientists on the one hand and administrators and the general public on the other.

Public education is important because until the public is persuaded of the efficacy of proposed management techniques and is prepared to demand, or at least to accept them, governments usually hesitate to attempt to put them into effect.

Organization and Interpretation of Research Findings. An urgent need not at present well met, is to have isolated research findings brought together, organized, and interpreted for the information of intelligent laymen. An urgent need is for scientists of some maturity to integrate and interpret the results of research having a bearing on the understanding and solution of problems of broad import.

Abstracting Services. Another urgent need in research is for means to enable research workers to learn what is being discovered throughout the world in the branch of science with which they are concerned. The magnitude of the problem for science as a whole is illustrated by the statement that more than a million scientific or technical articles are published each year in about 50,000 journals. Even in such a specialized field as wildlife and fisheries, it is impossible for anyone to keep fully abreast of advancing knowledge. Several international conferences have been held to consider this problem. In Canada the National Research Council has set up an Associate Committee on Scientific information, one of whose concerns is to review the problems of abstracting services for Canada.

Maintenance of Scientific Morale

The contributions of research scientists, both academic and applied, depend not only on their qualifications, but on their morale. A competent and highly trained scientist can have his value seriously reduced through treatment which discourages and frustrates him.

Basic to the maintenance of morale is mutual understanding and respect as between research personnel

and administrators. The importance of communication in contributing to this mutual understanding has been emphasized above.

On this problem Dr. C.J. Mackenzie, former President of the National Research Council, has said,–

"A suitable organizational philosophy is essential ..... Proper organization is not a matter of charts and directives, but of philosophy. The first step is to obtain recognition that a scientific research organization cannot be administered as effectively as ordinary industrial or administrative line organizations. Scientific organizations are not armies to be ordered–the orchestra is a better simile–but research men who can be led. They work as a group, but their status as soloists must be accepted."

Integration of Research

Among important and urgent needs in wildlife and fisheries research in Canada are media through which information can be exchanged, ideas as to needs discussed, and agreement reached as to how objectives will be undertaken. The agencies that should thus be brought together include federal and provincial governments, academic institutions, research councils and foundations, representatives of industries, and others.

This is not the time to plan these media in detail, but it may be useful to suggest a few principles. It is therefore suggested that:

1. Organizations for the interchange of ideas and for discussion of plans should be more in the nature of *ad hoc* organizations rather than statutory ones.
2. Allocation of responsibility for parts of a general plan should be on the basis of voluntary co-operation rather than through any form of pressure.
3. Provincial governments should be encouraged to undertake their own fisheries and wildlife research programs, however modest, rather than attempt to have all of their research done for them by federal agencies.

In its final report the Ontario Research Commission –created in 1946 "to inquire into and report upon all matters concerned with scientific and industrial research as they affect the Province of Ontario"– made the following general observations on government and industrial research as applied to Ontario:

1. In the first place, Canada is too large a country to warrant its entrusting the whole program of scientific research to one organization.
2. Control over the natural resources of the Province is a constitutional responsibility of the Province. Research into better methods of improving and utilizing the natural resources is also a provincial responsibility.

The Commission held it to be a normal function of the government of the province to take a leading part in promoting, co-ordinating, and supporting financially an extensive program of approved effort in this broad realm.

In the matter of *Dominion-Provincial Division of Research Funds*, the Commission recommended that in order that expenditures for research be allocated in proper proportion, it was imperative that an active liaison be maintained between the two governments. The Commission was of the opinion that if the most effective benefits from research were to be assured, each research unit should be close to the ultimate beneficiary. In other words, a province is more likely to apply the results of research if it does the research itself than if it is done by some other agency.

The Commission also observed that in order to make sure that the highest degree of co-ordination is obtained between the two governmental agencies, it would be necessary in the case of each project to determine carefully at the outset and re-examine frequently thereafter the division of responsibility for conducting the investigation concerned and for the provision of the funds supporting it.

A national committee should be created to co-ordinate research and plan research programs not already underway. Co-ordination cannot be imposed, but should be brought about voluntarily through discussion leading to understanding and agreement. Agencies represented on such a body should be the federal and provincial governments, universities, and perhaps industries.

There is also need for provincial or regional organizations to bring about similar understanding and agreement in the matter of provincial or regional problems.

How Much Research?

A weakness in the organization of research is the lack of understanding as to how much expenditure is necessary to meet the needs for the most effective conservation of our wildlife and fisheries resources.

There are many difficulties in estimating how much research is needed.

One of these is in deciding what expenditures are to be charged to research. This term is used for such a wide range of investigations, inquiries, studies, etc., that no uniformity in the use of the term research has so far been developed. Some organizations include expenditures on development under the heading of research.

Another difficulty is in evaluating the resource. This is especially true in wildlife and fisheries, whose value consists so largely in contribution to recreation. Such values contain so many intangibles that it is impossible to assign to them as definite a figure as in the case of commercial values. Nevertheless it should be remembered that the commercial value of wildlife and fisheries is only a part, and it may be a small part, of their real value.

The Problem of Increasing the Number of Competent Research Personnel.

At present, the number of students of first class ability undertaking training will not result in an adequate number of thoroughly trained research workers in many fields of biological research, including wildlife and fisheries.

The reasons many fields of biological research do not attract more and better students are many and complex, and not well understood. Among these appear to be the following, not necessarily arranged in order of importance:

1. The lower remuneration of those engaged in many kinds of biological research, including wildlife and fisheries, as compared with medical research on the one hand and research in the physical sciences on the other.
2. Lack of public knowledge of the nature of wildlife and fisheries research and of its contribution to human welfare.
3. The disability imposed on biology by the nature of the school curriculum in biology.
4. A curious but common concept that biology is less scientific than physics and chemistry and, therefore, attracts a lower grade of ability.

Efforts must be made to increase the number of students choosing a career in biological science, with special reference to wildlife and fisheries research.

Problems of a Mobile Resource—Migratory Waterfowl

W. G. Leitch,
Chief Biologist,
Ducks Unlimited (Canada)

Waterfowl are a mobile international resource that Canada, the United States, and Mexico are bound by treaty to perpetuate. In Canada, waterfowl are a provincial as well as a federal responsibility.

Since most waterfowl are produced in Canada, but harvested and wintered in the United States, close co-operation between the two countries is essential. Such co-operation has been manifest in the annual combined surveys of waterfowl production in Canada and the mutual agreement on hunting regulations, which distributes the kill equitably between the two nations and yet guards against over-utilization of the resource.

Preservation of the Canadian prairie breeding habitat is essential if waterfowl are to continue as a recreational resource both in Canada and the United States. Great effort and large sums of money have been spent in the United States to preserve what waterfowl habitat remains, but little has been done in Canada. Crop damage by waterfowl, public apathy, and pioneer attitudes toward land use are major obstacles.

Marshes where the public can hunt are becoming scarce in heavily populated areas in British Columbia and Ontario, and this situation will become worse.

The inability of most hunters to identify ducks precludes the introduction of more refined management practices which would result in better utilization of the resource. Development of better management techniques is also limited by lack of adequately co-ordinated research.

Jurisdictional Complexities Compound Management Problems

Migratory waterfowl, ranging the length of the North American continent and into South America, are transients in many countries, but completely the wards of none. Responsibility for waterfowl which occur in Canada is, however, primarily that of Canada, the United States and, to a lesser extent, Mexico.

Canada, where an estimated 70 per cent of North American waterfowl is produced, is the key partner. For unless Canadian production is maintained, southern refuges and wintering grounds developed by the United States will have little value, save to keep waterfowl from extinction. Some three million waterfowl hunters in the United States and Canada want more than that.

The Migratory Birds Convention Act between the United States and Great Britain (on behalf of Canada), signed in 1916, was the first international approach to waterfowl management. Mexico signed a similar agreement with the United States in 1935. Ratification of the 1916 treaty ended spring shooting and market hunting for waterfowl in the United States and Canada. It gave the federal governments of both countries the responsibility for perpetuating migratory birds and the authority to determine when and under what conditions migratory waterfowl may be hunted.

Management of the waterfowl resource is thus complicated by its inherent mobility and unique non-appropriable characteristics. Although most of the production takes place in Canada, the greater part of the kill occurs in the United States, where wintering habitat is supplied after the hunting season is over. The two countries are therefore, in the main, concerned with quite different management aspects of the resource which must be thoroughly integrated for good management. Close co-operation is essential if this is to be achieved. Restrictions on the shooting of canvasback and redhead ducks in Canada in 1960 were perhaps unwarranted by the extent of the Canadian kill alone. However, the kill in the United States was considered excessive in view of the existing numbers of those species, and to make restrictions on hunting

these species acceptable to American duck hunters restrictions had also to be imposed in Canada. In the end Canada will benefit, of course, since the kill is all from the one continental population.

Although final responsibility for migratory waterfowl is vested in the federal governments, internal jurisdiction is complicated by local state or provincial attitudes and problems, which are expressed by the game divisions of these junior governments. Saskatchewan, where crop damage is often serious, has often requested more generous bag limits on grain eating species of ducks than were in force elsewhere. Pressure is also exerted by influential private organizations ranging in outlook from those advocating the complete abolition of all hunting to those who resent almost any restriction at all.

Many aspects of waterfowl management require close co-operation between the United States and Canada. The establishment of an international commission, similar to the International Pacific Salmon Fishery Commission and The Great Lakes Fishery Commission, might result in more efficient management of this resource.

Co-operative Programs In Operation

Since production of waterfowl is largely in Canada and harvest in the United States, such basic management activities as inventory and regulation of harvest have international implications.

Beginning in 1946, the United States Fish and Wildlife Service (now the Bureau of Sport Fisheries and Wildlife) assumed responsibility for the annual spring inventory of nesting waterfowl and the summer brood surveys. The extent of the U.S. Bureau of Sport Fisheries and Wildlife operation in Canada is illustrated by the fact that, in 1960, eight men and five aircraft were used for the basic survey while ten men and one aircraft participated in the ground surveys complementary to the aerial work. Thirty three employees of the U.S. Fish and Wildlife Service and 15 from various states took part in summer banding activities.

Thirteen Canadian Wildlife Service personnel were engaged in ground surveys and research projects and five in banding. The provinces contributed four men to research and five to banding, and Ducks Unlimited contributed four to research and two to banding. The Toronto Hunters' and Anglers' Association operated a banding station in Ontario.

Aerial surveys were confined to the three Prairie Provinces, the Northwest Territories, and northern Ontario. Ground studies and banding were concentrated in the Prairie Provinces. Elsewhere, three study areas and two banding stations were operated in Ontario, two study areas and two banding stations in Quebec and Labrador, four research areas (one aerial) in the Maritimes, and one banding station in Newfoundland.

The Delta Waterfowl Research Station at Delta, Manitoba, which is sponsored by the North American Wildlife Foundation, an international group with both American and Canadian directors, continued research on basic waterfowl problems. A similar station, smaller in scope, is located at Fredericton, New Brunswick.

A major advance in waterfowl management came in 1948 when the United States first began to manage waterfowl on a flyway [1] rather than a national basis. Regulations since then have been based on the number of hunters and the waterfowl available in each of the four flyways, and have varied greatly between flyways. Flyway Councils, composed of the game administrators from each state in the flyway, with biologists forming an advisory group, were organized in 1952. Individual states have thus learned to plan for the long-term good of the flyway, rather than seize the opportunity of the moment.

Flyway planning may call for restraint on the part of the states where large populations of waterfowl occur from time to time. Management of the Horseshoe Lake goose flock, which winters in southern Illinois but migrates through the Horicon Marsh in Wisconsin, is an example. An agreement was reached in 1960 between Wisconsin and Illinois and the U.S. Bureau of Sport Fisheries and Wildlife that this flock of geese could stand a kill of 21,000 birds. Wisconsin was allotted 7,000 and Illinois 14,000. Wisconsin closed the season at Horicon as soon as its quota was killed, undoubtedly in the face of considerable public pressure since ample hunting opportunity remained.

Realizing that the origins of their waterfowl flights are in Canada, each flyway council has invited the neighboring provinces to join it. Some provinces have effectively participated in flyway council affairs, but others have not yet responded. Some states have further recognized the international character of the waterfowl resource by assigning their employees to banding projects in Canada and assuming a share of the crop depredation research work on the Canadian prairies.

Habitat Preservation The Most Urgent Management Problem

The Migratory Birds Convention Act, while eliminating some of the worst abuses, such as spring shoot-

ing, failed to recognize that the supply of suitable habitat was a prime factor influencing the numbers of ducks and geese. When the treaty was signed, both countries were undergoing a period of rapid expansion, and waterfowl were already being affected by intensifying agricultural activity as well as continually increasing hunting pressure.

In the early years Canada seems to have been more aware of the importance of habitat preservation than the United States, although in recent years this situation has been completely reversed.

As early as 1887, a federal Order-in-Council set aside the islands and shores of the north end of Last Mountain Lake in Saskatchewan as a breeding ground for migratory birds. In a later Order-in Council, dated 1925, which reserved several other areas in Saskatchewan and Alberta for the same purpose, the following noteworthy statement appears: "That the Great Plains region of Canada contains probably the most valuable breeding grounds in North America for the wildfowl of the continent and that it is important that measures be taken to set apart permanently certain areas for the propagation of bird life, a resource of economic value in providing sport and food"...and quoting again. "That the advance of settlement, following cultivation of the land, the drainage of lakes and marsh areas for development purposes has seriously restricted the areas suitable for the propagation of wild waterfowl and under present conditions it is necessary that proper means should be taken to check the decrease in the number of these birds and to guard against the danger of extermination." If this was true in 1925 it is true many times over in 1961. It is also interesting to note that in the same year, 1925, public shooting areas were established in the Prairie Provinces, thus assuring that the opportunity for harvest would be available to the general public.

Unfortunately, this enlightened dynamic approach was not transmitted to the Prairie Provinces when they took over land administration in 1931, nor was it continued by the federal government. Waterfowl management degenerated to setting bag limits and seasons and establishing sanctuaries at the request of local residents or organizations. This passive attitude, if pursued while waterfowl habitat continues to disappear, leads only to shorter and shorter seasons and smaller and smaller bag limits and, finally, the end of duck hunting as a recreational pursuit.

Habitat Preservation In The United States

In the United States, by the late 1920's, it was realized that protection was not enough to maintain waterfowl numbers, and in 1929 the Migratory Birds Conservation Act was passed, which authorized appropriations for land acquisition and habitat development. The Migratory Bird Hunting Stamp Act, of 1934 provided funds for acquisition by requiring every waterfowl hunter over 16 years of age to purchase a special $1 stamp annually. In 1946, the price of the stamp was increased to $2 and in 1958 to $3.

By that program the United States Government had, by 1959, put 3.5 million acres under management for waterfowl. In addition, the individual states owned or controlled 2.5 million acres of waterfowl habitat acquired with money from the Pittman-Robertson, or Federal Aid to Wildlife Restoration, Act of 1937. This Act makes available to the states the proceeds of an 11 per cent tax on sporting firearms and ammunition. These funds must be augmented with state appropriations in the ratio of 75 per cent federal and 25 per cent state. In the twenty years ending with 1958 a total of $57 million was spent under this program.[2]

Despite these programs, waterfowl habitat in the United States is still disappearing at an alarming rate due to drainage, industrialization, and over-utilization. According to the Fish and Wildlife Service,[3] the primitive extent of wetlands in the United States was 127 million acres, of which at least 45 million have been drained or otherwise destroyed to date. This occurred despite passage of several Acts designed to co-ordinate use of water and land for agriculture, navigation, flood control, and wildlife. The most important of these was the Fish and Wildlife Co-ordination Act of 1934, amended in 1946 and 1958, which was intended to assure state and federal agencies a part in planning for wildlife use in connection with water resource development projects constructed with federal funds or under federal license.

While the federal government and the individual states now have some six million acres under control, most of it is in large refuges which provide migration and wintering habitat, but produces relatively few waterfowl. On the other hand, much of the habitat lost through drainage and other causes consists of the small potholes and marshes where most waterfowl are produced. In the prairie states of Iowa and North and South Dakota, and in western Minnesota this has been particularly serious. Wetlands in Minnesota are being drained at the rate of five per cent a year with no sign of abatement. The U.S. Department of Agriculture, through the Soil Conservation Service, paid out $888,896 for drainage assistance in Minnesota in 1959 and $1.5 million in 1958.[4]

The United States is thus left with the dilemma of a substantial investment in refuges and wintering grounds and steadily dwindling production habitat from whence the ducks to utilize these refuges must come. The U.S. Bureau of Sport Fisheries and Wildlife, aware of this parodox, is now attempting to use duck stamp money to obtain control of as much of the duck producing habitat as possible.

Lansing A. Parker, Assistant Director of the U.S. Bureau of Sport Fisheries and Wildlife, outlined the current habitat acquisition program to the delegates to the Dominion-Provincial Wildlife Conference at Regina in June 1960. The objective is to preserve 1,750,000 acres of essential waterfowl habitat in western Minnesota, and North and South Dakota. Tracts of about 160 acres containing one or more relatively permanent potholes plus any number of temporary water are as will be purchased. Twenty-year easements on surrounding farms will also be secured. During that period the land-owners will be paid not to drain, fill, or burn their wetlands. The first year (1961) budget for this program will be $500,000. This will be increased to between $1 million and $1.5 million for each of the next three years, and to $2 million by 1965. The objective should be reached in 25 years, at which time 675,000 acres will be in fee title and 1,075,000 under easement. The cropland, hayland, and pasture on the purchased farms will be rented to nearby farmers, or traded for wetlands after deducting the 25 per cent reimbursement to the counties for payment in lieu of taxes.

Some Minnesotans, alarmed by the loss of wetlands through federal drainage subsidies, inaugurated the "Save Minnesota Wetlands" program in September, 1951, to save small wetlands by outright purchase. Money was at first obtained by public subscription, but in 1957 the Minnesota legislature recognized the need for additional funds for acquisition of wetland and other wildlife lands and added a $1 surcharge to the small game hunting licence. Pittman-Robertson funds and money from hunting licences have also been used. As of October 31, 1960, a total of 81,953 acres had been acquired at a cost of $2,541,500.[4]

Canadian Prairie Habitat Must Be Preserved If Wildfowling Is To Continue

In spite of these strenuous efforts by the U.S. Bureau of Sport Fisheries and Wildlife and the State of Minnesota, the key to the future of waterfowl lies in Canada. Waterfowl managers, both in the U.S. and Canada, are aware of this. What Canada does about the preservation of production habitat within her borders will determine the fate of the continental waterfowl population. Ducks must be produced before they can be managed.

So far, except for the Orders-in-Council which set aside some areas for breeding purposes, some of which were subsequently cancelled by the provinces, Canada has done little to fulfil her obligations as a joint owner of the waterfowl resource except to set seasons and bag limits. Almost the only improvement of waterfowl habitat in Canada has been done by Ducks Unlimited (Canada) which, since 1939, has spent $6.5 million, collected from American sportsmen, in Western Canada.

The misconception that the most important waterfowl breeding areas lie in the remote Canadian north is widely held. Actually, the prairies and aspen park lands are the heart of the waterfowl breeding area. Drought there brings an immediate reaction in waterfowl numbers, as the mid-1930's revealed and the dry years of 1946, 1949 and 1959 confirmed. Had habitat in the North been as suitable for waterfowl production as that in the prairies, the severe depressions in duck numbers in those years would not have occurred. Waterfowl have a high reproductive potential, and their populations have a resilience which enables them to rebound quickly when water restores the habitat. Waterfowl populations will always fluctuate with dry or wet years on the prairies, but drainage, it should be remembered, is permanent drought from which there can be no rebound.

The area of three Prairie Provinces is approximately 753,500 square miles, but the prairie and aspen parklands, 166,400 square miles (106,496,000 acres), contain the most valuable waterfowl habitat. This is by no means homogeneous habitat. The average breeding populations in the mid 1950's in settled Saskatchewan and Alberta averaged about 30 pairs of breeding ducks per square mile, varying from almost zero in the intensively cultivated flat lands to 185 pairs per square mile in the pothole grazing areas.

Yearly variation in the number of water bodies is great. The settled area of Saskatchewan, which includes the best duck habitat in that province, is estimated to have 20 million acres of water in the spring of a very wet year. In an average year there are probably about 2 million. By fall, in a dry year, only 500,000 acres may remain. Accurate figures for the above are not available and those presented must be considered very rough estimates only.

The Northwest Territories and the Yukon total 1.5 million square miles. There a thin duck population

is scattered throughout, with local concentrations approaching prairie densities in favorable habitat, usually in river deltas or flood plains.

This may seem like a good deal of habitat, but the situation is far from satisfactory. In the heart of the breeding range, waterfowl are competing with agriculture for water and living space and are continually losing ground through agricultural encroachment and drainage. Many water bodies no longer have any value to breeding waterfowl. Little effort is being made to conserve the habitat, and in this respect Canada is not fulfilling her obligation in the field of international waterfowl management.

Pioneer Attitudes And Misconstrued Progress

This neglect by the prairie governments, as well as by Ottawa, stems from the bounty which Canada enjoys and the pioneer attitudes toward land use which still persist. In Western Canada, at the present time, there are ample waterfowl for Canadian hunters, and the opportunity to hunt is scarcely limited. What is seldom appreciated is that there must be enough ducks for Americans too, or they are unlikely to continue to supply wintering and migration habitat. Without this essential co-operation it won't be long before there won't be enough waterfowl for Canadians, either.

In our pioneering tradition subjugation of nature is still equated with progress, and any activity which brings more land under cultivation is progress, regardless of what other values are destroyed. This attitude persists because in Western Canada the use of land and water is usually dictated by agricultural considerations alone, regardless of what else is lost in the process. The face of the countryside is being changed and our environment and way of life permanently altered, without regard for values other than the requirements of agriculture.

The sportsman has shown an appalling lack of vision in not demanding a dynamic waterfowl management program. Only in the last few years have the provincial sportsmen's organizations become aware of the increasing destruction of waterfowl habitat. It is only now that consideration for the wildlife values of undeveloped lands is beginning to be demanded and the relation between production and shooting areas understood.

The disposition of wetlands is a matter of public concern since in many instances they are Crown lands. Was it in the best public interest that in so many instances marshes were drained to accommodate farmers who owned only a very small part of the area? The remainder was Crown land, belonging to everyone. Buying the flooded patended land would, in many instances, have been cheaper than drainage and, in addition, would have preserved a recreational area which in the years to come will be in great demand. There is no difficulty in meeting the demand for wheat, but the demand for recreation continues to grow with increasing leisure and population.

Canada can ensure that waterfowl will always exist as a recreational resource and without the great outlays of money now necessary in the United States. All that is required is to retain and manage the habitat that already exists, but to accomplish this, waterfowl must be considered in the disposition and use of all water and land on the prairies.

Community pastures in Saskatchewan and Manitoba in 1958 comprised a total of 1,811,985 acres.[5] Community pastures are largely submarginal for cultivation, but contain much high quality game range. Yet this vast acreage is being developed in the interests of the livestock industry exclusively. Good pasture management is sometimes, but not always, inimical to waterfowl. Where there is conflict in use, production of waterfowl should be considered sufficient justification for retention of some marsh areas, even if the carrying capacity or hay production of the pasture is reduced.

Both provincial and federal governments should refrain from subsidized drainage where the only justification is political expediency. The greatest threat to waterfowl habitat lies in drainage programs subsidized or promoted by government organizations concerned with keeping themselves big.

In "Wetlands of the United States"[3] the following appears: "Of approximately 65,000,000 acres of wetlands given to the states, nearly all are now in private ownership. The landowners can do with them as they wish. It is unfortunate that water conservation and waterfowl protection areas were not selected and set aside for public benefit at numerous locations before the lands were transferred from federal ownership. If this had been the case the government would not now be in the position of buying these 'wastelands' at high prices". With this example before us it is to be hoped that Canadians will not look back twenty years hence with the same nostalgia.

Public Apathy And Crop Damage Major Obstacles

Although the major waterfowl problem in Canada is habitat preservation, no concerted effort is being made to solve it. This is due to public apathy resulting from a lack of understanding of the situation, and because in the Prairie Provinces the damage waterfowl

do to cereal crops in some years has created a political atmosphere unreceptive to any program proposing to increase waterfowl.

Public apathy could be transformed into action by a publicity program which would make sportsmen aware that, unless action is soon begun, the end of waterfowling is a very real prospect. In the Eastern Provinces, where wintering and public shooting areas are in short supply, acquisition may require only sufficient public demand. Action in the Prairie Provinces, however, requires not only public demand, but also some solution to the crop damage problem, before the right political atmosphere can be created.

Damage to cereal crops by waterfowl dates from the beginnings of agriculture, especially where farming was adjacent to waterfowl concentration areas. In 1913 an amendment to the Saskatchewan Game Act was recommended which would allow farmers to shoot ducks damaging their crops, without fear of prosecution.

Of the many species of waterfowl, only mallards and, to a lesser extent, pintails and widgeon are involved. The other species rarely leave the marshes, and geese are seldom harmful.

Introduction of swathing greatly increased duck damage. While not serious every year, it can be substantial in cold wet harvest seasons. Considering the economy of Western Canada as a whole, the loss is unimportant, but to the individual farmer, whose loss it is, it can be a hardship. Farmers so afflicted are usually sufficiently vociferous to arouse the sympathy of their neighbors, and the local member of the legislature is keenly aware of the unpopularity of any program intended to benefit ducks!

Waterfowl biologists and administrators recognize that the crop damage problem is serious and a major obstacle to any progress in waterfowl habitat preservation. For three years, biologists from the several organizations working with waterfowl in Canada have combined with state and federal biologists from the United States in an effort to find a solution. So far, the results have not been too encouraging. Shooting, scaring devices, and feeding stations are effective locally, but are subject to failure with cold rainy weather or impassable roads. A crop insurance program for wildlife damage, similar to that in operation in Saskatchewan and contemplated for Alberta, seems to hold the greatest promise countrywide. Such insurance should be paid for by all waterfowl hunters and would thus include hunters in the United States. If the scheme were set up on an international basis, Canadian hunters would also have to expect to help pay for waterfowl damage in the United States, where losses are particularly heavy in California. The actuarial and administrative problems are many; opportunity for abuse would admittedly be present, but a program of such magnitude will be necessary before the first real progress in habitat preservation and acquisition can be made.

Hunting Areas Also Restricted In Some Provinces

Other than in the Prairies and in British Columbia, the urgency is not so much for preservation of production habitat as for maintaining a place where the ordinary citizen can hunt waterfowl. In Eastern Canada, black duck, ringneck, and goldeneye are the more important species and, since they are wilderness breeders, their breeding habitat has not been seriously impaired by man. Agriculture and industrialization have, however, eliminated many southern concentration and shooting areas. Many of those remaining are now in private hands, Canadian and American.

Wright[6] says that the breeding habitat of New Brunswick is underpopulated with waterfowl and that close co-operation in control of the kill in the Atlantic Provinces and States is required before the breeding habitat can be fully utilized. He says that the intensive predator control compaign in the St. John River estuary appears to be increasing production. Lemieux[7] agrees, stating that in Quebec, waterfowl populations are more likely to be affected by what happens on the wintering grounds since the breeding grounds are relatively undisturbed. Mason[8] believes a program of marsh acquisition is important in Nova Scotia, and that a strong effort should be made to increase the breeding capacity of the existing marshes and wetland. Walters[9] does not consider breeding habitat a problem in Newfoundland. The major problems in that province are associated with the harvest.

British Columbia combines prairie waterfowl problems with those uniquely her own. Much of the production habitat is in wilderness areas, but grazing pressure, a prairie problem, is of concern in the Cariboo District.[10] Hatter also draws attention to the elimination of wintering habitat by industrialization, and the decrease in extent of public shooting areas through the acquisition of control by private interests. Plans for deep-sea docking facilities threaten to eliminate the big Lulu Island marshes. Duck Lake, in southeastern British Columbia, an important stopover for spring and fall migrants and an essential

link in the Pacific Flyway, is saved from drainage only by continued vigilance.

In summation then, all across Southern Canada waterfowl habitat is being continually reduced by the pressure of agriculture and industrialization. With the habitat will go the ducks. On the prairies vital production habitat is threatened. With time, and if the trend continues, public shooting areas will also, inevitably, be in short supply. In British Columbia and the Eastern and Maritime Provinces, a place to hunt is already the problem and one which is expected to worsen rapidly.

Management Hampered By Hunter Ignorance And Lack of Research

Progress in waterfowl management is further limited by the waterfowl hunters' lack of knowledge, both of the birds they hunt and the problems connected with them. Aside from really keen individuals, most cannot identify the ducks in their bags let alone in the air. If hunters could identify ducks quickly and accurately, harvest of a species in short supply could be curtailed, and restrictions on species which are under-harvested, liberalized. It would be possible to have a season on early migrants, such as the blue-winged teal, and yet delay the opening of the general season until the other species were mature. Perhaps bluebills are under-harvested: bag limits could be adjusted to take additional birds of this species. How to educate hunters to the level required for species management seems an almost insurmountable problem.

Effective waterfowl management is further hampered by a lack of facts which can be supplied only by research. Some major contributions have come from the Delta Waterfowl Research Station in Manitoba. The Northeastern Wildlife Station at Fredericton, New Brunswick, has made important additions to the knowledge of the black duck. Results of researches by the Canadian Wildlife Service, some at present nearing completion, should soon be available for assimilation into the general body of waterfowl knowledge.

Much additional research is required. Without any intent to arouse the controversy of *pure* vs. *practical* research, it should be emphasized that there is urgency here and hardly time for research which may or may not have practical application to the pressing problems at hand.

Research needs better co-ordination. The many divergent facets of waterfowl research now being undertaken should have been designed for integration into a general plan applicable to current problems. Ideally, the agencies engaged in waterfowl research should agree on objectives and each assume a part of the work required to reach these objectives. There is a real danger that twenty years from now, though we may know a good deal more about waterfowl, it may still be impossible to coalesce these divergent facts into a usable body of knowledge.

A critical problem connected with research is getting the results into print. Frequently the work is completed to the thesis stage, when the investigator takes employment elsewhere and the results are never published. Scholarships, which would support graduate students at a reasonable standard of living until their work was published, would make research much more effective. Completion of publications by government research workers is apparently often impeded by the need to undertake administrative tasks.

Urgent research problems include the following:

1. Detailed life histories of the principal waterfowl species used as game. Students at the Delta Waterfowl Research Station have worked on the breeding behavior of the pintail and the nesting behavior of the redhead, canvasback, and lesser scaup. An investigation of migration and hunting mortality in the canvasback, currently under way, seems likely to produce results that will have immediate application to management of this species. Life histories of all important species should be completed. Knowledge of this sort is essential to species management. As Hochbaum[11] has said, "... at the present time we manage waterfowl as though all species were mallards".

2. Waterfowl ecology is still in its infancy. We need to know how waterfowl use their environment and what determines carrying capacity and production. Intensive management will require detailed insight into these factors, for the problem in the coming years will be to produce more and more waterfowl on dwindling habitat.

3. We need to know more of marsh ecology and the life histories of the marsh and aquatic plants important to waterfowl before we can manage marshes for maximum production.

4. Bag limits, seasons, and regulations of the techniques for taking waterfowl have been management tools for sixty years, yet their effect on waterfowl populations and individual species has never been clearly ascertained. This is a difficult problem, but one which must be undertaken; for until it is, we are groping in the dark so far as regulations are concerned.

5. Research should be undertaken to reduce the annual loss of ducks to disease. It is estimated

93452—60½

that botulism in 1960 was responsible for duck mortality in Manitoba equal to more than six per cent of the 1960 Manitoba harvest of ducks.[12] Losses from botulism have been much greater in some years and occur in Saskatchewan and Alberta with equal severity.

Conclusion

It should now be apparent that waterfowl management in Canada is neither small nor simple. To do the job adequately will require considerable money and, perhaps most difficult of all, basic changes in water and land use policy and in our attitude toward our environment.

Can we justify reservation of wetlands for waterfowl production which, if drained, might raise wheat? I think we can, certainly to the same extent that agriculturists can justify growing more wheat when granaries are already bulging with grain. There is a market for ducks – a demand far in excess of supply and unlimited evidence that the demand will increase. Grain makes business, but so do waterfowl –$119 million worth in the United States in 1955! The greatest return, however, is not monetary, but in healthful outdoor recreation.

How many people use the resource? In 1958 in excess of 300,000 Canadians hunted waterfowl, and many hundreds of thousands just enjoyed them. They are very much a part of the Canadian scene. The recent popularity of waterfowl and outdoor scenes on greeting cards, and repeated references on radio and television to waterfowl and hunting opportunity attest to this fact.

With shorter work hours, demand for outdoor recreation is increasing much faster than population growth. Between 1946 and 1956 the population of the three Prairie Provinces increased by 20 per cent and in the same period the number of waterfowl hunters by 238 per cent. The growing proportion of urban dwellers adds continually to the demand for outdoor recreation.

Charles Foster, Massachusetts Commissioner of Natural Resources, can be quoted with profit.... "There has been an almost universal tendency by man to relentlessly remove his outdoor surroundings only to seek them vigorously elsewhere once they are no longer in reach". The steadily increasing number of Americans hunting waterfowl on the Canadian prairies testify to the truth of this statement. Where will Canadians hunt in twenty years? There are no frontiers left!

Kenny and McAtee[13] said, "Among the assets of mankind, wildlife receives its true appraisal only in advanced stages of civilization, when, owing to the heedless destruction of earlier times, it has been seriously, if not irreparably, reduced. Under pioneer conditions the rules for the treatment of wildlife are immediate exploitation of the useful, and drastic destruction of the useless, and *these rules tend to remain in effect long after the original motives are gone**. In the earlier stages of settlement no one thinks of allotting any land for the use of wildlife; the effort is to wrest every possible acre from nature and make it yield an income. There is no vision to see, there is no time to learn, that land units with their natural occupants, exemplified by a beaver meadow, a muskrat marsh, a duck lake, a deer forest, or an antelope mesa, are productive entities far more than anything man can put in their place and that once destroyed may never be re-established".

Waterfowl are a unique component of our renewable resources. The integrated management of such resources may well be a test of the maturity of Canada as a nation.

* Author's italics.

Notes and References

[1] *Flyways* are administrative regions which correspond roughly to the broad routes followed by migrant waterfowl.

[2] Official release, Information Service, Department of the Interior. June 7, 1959.

[3] Circular 39, *Wetlands of the United States*.

[4] (Letter) James W. Kimball, Director, Division of Game and Fish, Minnesota Department of Conservation.

[5] Annual Report of the Prairie Farm Rehabilitation Branch of the Canada Department of Agriculture. 1958–59.

[6] (Letter) Bruce Wright, Director, Northeast Wildlife Station, Fredericton, N.B.

[7] (Letter) Dr. Louis Lemieux, Canadian Wildlife Service, Sillery, P.Q.

[8] (Letter) Clarence A. Mason, Director of Conservation, Department of Lands and Forests, Halifax, N.S.

[9] (Pers. Comm.) H.W. Walters, Director, Wildlife Division, Department of Mines and Resources, St. John's, Newfoundland.

[10] (Letter) Dr. James Hatter, Chief Game Biologist, Department of Recreation and Conservation, Fish and Game Branch, Vancouver 1, B.C.

[11] (Letter) H. Albert Hochbaum, Director, Delta Waterfowl Research Station, Delta, Manitoba.

[12] (Pers. Comm.) E.F. Bossenmaier, Senior Game Biologist, Game Branch, Winnipeg, Manitoba.

[13] *Soils and Men* – U.S. Department of Agriculture Year Book, 1938.

Pesticides and Wildlife in Canada

Clarence Cottam,
Director, Welder Wildlife
Foundation, Sinton, Texas.

Chemical controls are so useful and contribute so much to our economy that continuance of their use is assured. The need is to see that controls are applied in a way that will be both effective and least damaging to other interests and resources.

In relation to income from agriculture and forestry, Canada spends less than half of the United States bill for pesticides but, nevertheless, pesticide consumption increased 3.5 times in the 12 years from 1947 to 1959.

Poisonous pesticides have been produced and widely used much faster than funds have been made available for studies of long-time, indirect, or even immediate effects of pesticide application on terrestrial and aquatic wildlife.

However, well co-ordinated and objective studies on the effects of pesticide applications have been carried out on Canadian forests where fish are an important resource likely to be affected. No adequate substitute pesticide has been found for DDT, but it is hoped that greater dilution will give satisfactory control with little or no injury to fish or other wildlife resources. Work is also being done on a control of biological origin which would be sprayed in a solution of water. Despite all efforts, the budworm is spreading.

Canada has used minimum rather than maximum dosages of pesticides in treating agricultural lands, and the evidence available indicates damage to wildlife has been less than in the United States. The Prairie Provinces of Canada comprise the area most likely to experience an upsurge of control because of the grasshopper problem.

Routine, repetitive application of widely toxic pesticides frequently creates serious problems by destroying the parasites and predators of pests. Nova Scotia fruit growers recognize the important role of biological control agents and endeavor to combine biological control and specific chemical control.

The high concentrations of DDT used to control the Dutch elm disease in Eastern Canadian cities and towns have had serious effects on attractive bird life. Little research has been done on the effects on wildlife of DDT mosquito and black fly control programs.

Relatively few studies of the effect herbicides have on terrestrial wildlife have been conducted, despite the fact that in 1959, for instance, 11.5 million acres of land were treated with 3.8 million pounds of herbicides.

The use of rodenticides also needs careful evaluation. Chemicals and other products of our civilization contaminate the land, air, and water. Industrial and agricultural consumption of toxic chemicals may constitute a health hazard and certainly creates an imbalance in our environment [83]. We must seek the information that will enable us to be more precise in our judgements and thus develop a broader view of environmental ecology and learn how the household of Nature may be kept in order.

Wildlife represents but one facet in the renewable resource base, and all of these renewable resources are interdependent. It is pertinent to emphasize that our wildlife and fishery resources cannot successfully be managed in the broad public interest apart from the management of soil, water, forests, farms, and ranches. Wildlife is as much a product of the soil as are corn, wheat, or cattle. Poor hunting and poor fishing usually are as characteristic of poor land and water management as are the scanty agricultural crops produced.

The Place of Pesticides

Generally each step forward in economic progress involves a step backward for certain other values. Each advance usually brings incidental losses, some of

which cannot readily nor very accurately be reckoned in dollars and cents.

Chemicals useful in controlling man's pests belong in this category of mixed blessings. Like fast moving automobiles, airplanes, atomic power, guns and ammunition, they clearly manifest potentialities of great harm as well as unlimited good. Chemical controls, like many other new products and inventions, are so useful and contribute so much to our economy that continuance of their use is assured. We may hope that in a progressive and enlightened society chemical formulations, dosages, and techniques of application will be so improved that more good and less harmful effects will follow.

Responsible wildlife people do not question the public need for chemical, biological, and other effective controls of insects and other pests or diseases. They realize that those controls, skilfully used where there is a proven public need, and where other interests and resources are appropriately considered and co-ordinated, are in the public interest and are here to stay. Wisely and co-operatively applied, under responsible leadership, pesticides have done much to improve agriculture, effect better health, and generally improve our way of life [28]. The criticisms against the use of chemical pesticides have come about largely because of real, assumed, or suspected adverse effects on human health, and lack of consideration of other resources that are known to be adversely affected by control programs.

Canada's agricultural, forest, and range crops are an important element of her economy. Obviously, the need is to see that safe and economical controls are applied in a way that will be both effective and least damaging to other interests and resources.

While the costs of control programs are high, it is significant that the cost of control to protect agricultural and forest crops in Canada is proportionately less than half of that in the United States. To gain protection against disease, insects, and other pests, Canadian agricultural interests in 1954 spent about $13.3 million for chemical controls to protect a $4.7 billion agricultural and livestock industry, while the United States spent about $240 million dollars to protect a $40 billion industry [20] – a rate more than twice the Canadian rate.

Extent of Pesticide Use in Canada

Detailed summaries of up-to-date pesticide use in Canada are not available. However, our data indicate an increase of a little over 70 per cent in most pesticide use between 1954 and 1959. Brown, [20] summarized known data on pesticide consumption for 1954 (Table 1).

Total pesticide consumption in Canada, as compiled by the Dominion Bureau of Statistics [1], since statistical recording began in 1947, has increased 3.5 times in the 12 years between 1947 and 1959, as the following figures, expressed in total value and percentage annual increase or decrease, indicate:

Year	Wholesale Value of All Pesticides as Expressed by Registrants	Percentage of Increase or Decrease
	– dollars –	– per cent change –
1947	7,200,484	(First Official Record)
1948	10,315,754	43.26+
1949	12,159,844	17.88+
1950	13,557,741	11.50+
1951	15,801,002	16.55+
1953	17,686,899	11.94+[a]
1954	19,456,601	10.01+
1955	22,853,337	17.46+
1956	24,685,259	8.02+
1957	19,624,783	20.50–
1958	20,601,458	4.98+
1959	25,322,972	22.92+

[a] 1953 compared with 1951; 1952 data not available to the writer.

Changes in pesticide use and the relative size of different segments of the industry can be visualized by comparing wholesale values as recorded by registrants during four selected years of the 12-year period, from 1947 to 1959, since statistics became available. Also shown are percentage changes from one period to the next.

Brown concluded that some 12.3 million acres of Canadian agricultural lands were treated in 1954 with various pesticides, and this was only about 70 per cent of that estimated by government agricultural officials as acreages likely to be sprayed economically. The major part of that acreage included the high figure of more than 11.5 million acres covered with herbicides, mostly in the agricultural belt of the Prairie Provinces. Other large agricultural areas treated included: large fruits, 168,000 acres; small fruits and berries, 35,000 acres; potatoes, 250,000 acres; tobacco, 95,000 acres; corn, 30,000 + acres; tomatoes, 32,000 + acres; peas, 20,000 + acres; sugar beets, 10,000 acres; cabbage 9,000 acres; miscellaneous

Table 1. Pesticide Consumption, Canada, 1954

Pesticide	Pesticide Compounds	Quantity
Herbicide	2,4—D (mostly liquid ester)	3,328,000 pounds
"	2,4,5—T ester + mixture with 2,4—D	226,000 "
"	Miscellaneous other herbicides [a]	224,500 "
TOTAL		3,778,500 "
Fungicide	Mercury and Bordeaux compounds	671,000 "
"	Dithiocarbamates	1,889,000 "
"	Sulphur compounds [b]	6,346,000 "
"	Copper compounds	6,280,000 "
TOTAL		15,186,000 "
Seed Treatment	Organic Mercurials [a]	707,000 "
"	B.H.C.	145,000 "
"	Fungicide and lindane	278,000 "
"	Lindane and aldrin	137,000 "
TOTAL		1,267,000 "
Insecticide	DDT [b]	4,696,000 "
"	Methoxychlor	40,000 "
"	B.H.C. dust	111,000 "
"	Lindane [b]	131,200 "
"	Chlordane [b]	191,200 "
"	Aldrin [a]	380,000 "
"	Dieldrin [b]	29,000 "
"	Malathion [b]	452,600 "
"	Dinitro Compounds	25,000 "
"	Rotenone dust	575,000 "
"	Ryania dust	61,000 "
"	Nicotine compounds	87,000 "
"	Arsenic compounds	7,204,000 "
"	Miscellaneous (soil fumigants, oils, DDD, TEPP and Toxaphane [a]	311,100 "
TOTAL		14,294,100 "

TOTAL PESTICIDES

Herbicides	3,778,500 pounds
Fungicides	15,186,000 "
Seed Treatment	1,267,000 "
Insecticides	14,294,100 "
Grand Total	34,525,600 "

[a] Including some pesticides expressed in dollar value and assumed to be worth $1 per pound.

[b] Including some liquids expressed in gallons and assumed to weigh eight pounds per gallon.

crops, 324,000 acres. This makes a total of about 12 million acres treated in 1954. In addition, about 27 million acres of Canadian crops are sown with seeds chemically treated with fungicides. Not included in the figures above are the large but unknown areas of roadside and railway allowance treated with herbicides.

Of the immense acreages treated with herbicides, the greater part, nearly 83 per cent, is treated by the farmer or grower himself. Custom ground treatment covers a little over two per cent, and aerial custom operators cover a little less than four per cent of the total acreage [20]. The rest, about 11 per cent, is treated by ground equipment through arrangement with neighbors or community organizations. Forest insecticide treatment is, of course, applied by airplanes. In 1953, 1.8 million acres of New Brunswick forests were treated against the spruce budworm; in 1960, 2.6 million acres.

Effects of Pesticides on Wildlife

The effects of pesticides upon wildlife, like other organisms, are influenced by a great many factors including natural resistance and susceptibility of wildlife species; the toxicity of the particular toxicants, their formulation and concentration, rate of application, carriers or type of solvent used; form of spray, whether dust, emulsion, or solution; frequency of application, time, place, and mode of application, ecology of the area concerned whether applied on land or water, soil type, degree of organic content of the soil, size and shape of area treated; mobility, life cycles, feeding and other habits of organisms in the treated environment; and condition of health, stage of reproduction, and life cycle of the wildlife in the treated environment.

While much study and experimentation have been devoted to effects of pesticides on wildlife [26,27,28,29,30,33,37,53,57,64,66,67,81,106,108,130,135,136,137], it should be made clear that pesticide production is a profitable enterprise and poisonous pesticides have been produced much faster than funds have been made available for accurate studies of even the immediate effects these pesticides have on terrestrial and aquatic wildlife, including fisheries. Very much less is known of the long-time, indirect, or side effects of pesticide application. Despite comments to the contrary, there may be serious and long-continued effects following the use of many modern chemical pesticides [31,36,38,47,56,63,70,82,96,109,131,132]. Some chemical industries have recently been pursuing development of more selective pesticides. This development must proceed.

Space will not permit a documentation of the too frequent adverse effects of pesticide use on wildlife. A few important references in addition to those recorded elsewhere in the paper which deal with this subject are here included: [2,12,13,15,18,32,35,39,42,44,46,59,74,76,97,98,

Table 2. Wholesale Values of Pesticides Used in Canada, 1947–59

	1947	1950	1955	1959	1947 to 1959
Agricultural Dusts and Sprays	$3,936,426	$ 4,661,416 18.42%+	$ 7,834,174 68.06%+	$ 9,630,141 22.92%+	144.64%+
Livestock Treatment	448,979	623,626 38.90%+	4,798,100 669.39%+	1,747,858 63.57%−	289.30%+
Herbicides	1,046,248	5,762,669 450.79%+	5,730,197 0.56%−	7,608,144 32.77%+	627.18%+
Household and Industrial Insecticides	1,560,631	2,342,597 50.11%+	4,104,352 75.21%+	5,404,943 31.69%+	246.33%+
Rodenticides	208,200	167,433 19.59%−	386,514 130.85%+	446,886 15.62%+	114.64%+
Miscellaneous or Details not Available				485,000 38.57%+ from 1957 to 1959	—
Totals	$7,200,484	$13,557,741 88.29%+	$22,853,337 68.56%+	$25,322,972 10.81%+	251.68%+

[10,111,119,134,138]. Fortunately for Canada, most, but not all, of these examples of adverse effects of pesticide use come from the United States where the approach to pesticide use has been less conservative and where the announced objective of some programs, such as the fire ant and Japanese beetle projects, has been eradication rather than control. The facts, as I understand them, suggest that co-ordination between agencies in Canada may have been more successful in preventing damage than in the United States. If there has been better administrative guidance of Canadian control programs, compared to the U.S., this may reflect bigger and more extensive operations south of the border and, therefore, more mistakes. In any case, the controversial and complex nature of many control programs suggests the need of rather frequent objective appraisal of progress, trends, and philosophies.

Forest Sprays and Their Effects

Some of the most scholarly and objective studies of the effects of pesticide applications are those that have been conducted on some of the Canadian forests where fish are an important resource likely to be affected. A number of these studies could well serve as models of procedure and as standards for effective co-ordination between government departments. They have demonstrated that essential pest control and wildlife conservation need not be antagonistic. Especially noteworthy studies were conducted on the Miramichi River in New Brunswick [11,41,64,66,70,71,72,136,137] (under various workers, the Canadian Department of Agriculture Research Branch of Forest Biology summarized the progress that has been made; thus, a good picture of the work underway is given) on forest areas on the northern portion of Vancouver Island, and adjacent coastal areas in British Columbia [4,24,33,65,73,84] in determining the effects of the spraying on fishery resources, their food chain, and on the pest insects that were the object of the control program.

Studies on the upper Miramichi River watershed forest in New Brunswick showed that ½ pound per acre, of DDT in oil killed up to 91 per cent of young salmon, and all size groups of young salmon were seriously affected. Aquatic insects also were largely wiped out and some of these were not re-established 16 months later. As expected, an alarmingly reduced Atlantic salmon run was noted in 1960 when the 1956 hatch returned to spawn in their accustomed river system. Because of the spraying in some tributaries, there is expected to be only a 25 per cent normal run of salmon in the 1961 run. There are poor prospects for good catches of salmon over the next few years.

Recently, encouraging progress has been apparent in the application of ¼ pound per acre of DDT in oil to control budworms in forest areas where streams contain valuable fishery runs. Tests have been made on pesticides to replace DDT but no substitute has yet been found adequate under Canadian conditions. Studies underway in New Brunswick and British Columbia give much encouragement to the hope that uniform application of ¼ pound of DDT in ¾ gallon of oil

emulsion in a fine spray will give satisfactory control with little or no injury to fish and other wildlife resources. There is also the hope that a selective control of biological origin, a crystallized derivative of the bacterium *(Bacillus thuringiensis)*, may be practical and effective against budworms when sprayed in a solution of water.

On the west coast, where one pound of DDT was used per acre in 1957, the year's escapement of fish was almost eliminated, and the loss of aquatic insect and fish food was equally hard hit. Tests indicate that a safe concentration of the DDT formulation is below 0.05 p.p.m. Co-operation by private logging companies and the government gives much encouragement for a reasonable solution in the not too distant future to the pesticide problem in those coastal areas.

Despite the excellent studies conducted in the coastal areas, and the well co-ordinated, co-operative, approach, a few disturbing facts stand out in bold relief: (1) Despite an efficient, well organized, and skilfully executed control program, using the stable and rather broad spectrum DDT, the budworm has generally increased in distribution and destructive force except for relatively short periods. It is alarming that there is no end in sight. (2) The destruction of anadromous fish of high economic value has been serious, even though there is great hope for lessening of this loss. (3) Spraying costs are exceedingly high and are going higher largely because of the continued spread of the budworm.

These facts might suggest the need for an objective review of the basic philosophy of control. With our broad spectrum controls are we killing off the natural predators, parasites, and diseases of the budworm and other damaging pest organisms of the forests? Might we be wise to direct intensified basic research toward more effective biological and cultural controls to supplement more specific and less ruinous chemical controls? Entomological history suggests that rarely can we obtain necessary control by relying solely on chemical pesticides. There may be wisdom in Pickett's statement [100] referring to orchard control: "Can we disregard biological control or environmental resistance in any form? ... if we seriously upset the natural balance by the use of chemicals and have to depend entirely on chemical control, will it not be necessary either to achieve eradication or to carry on such an ever-enlarging program of control that the expense cannot be justified?" Perhaps we would be wise to take a new look at the ecological approach to this problem. [48]

Studies in interior Canada of forest spraying with concentrations of ¾ or 1 pound, per acre, of DDT in oil used to control forest insect pests show that the damage to fish and wildlife has been very much less than on coastal areas where anadromous fishes of high value come inland to spawn and spend their early life cycle. Langford [77,78,79,80] found that ¾ pound of DDT in a soluble oil carrier was effective in killing most aquatic insect larvae and nymphs which serve as the basic food of many stream fishes in the Port Arthur district of Ontario. He and Mackie [94] and Speirs [117] concluded that there was little direct injury to mammals and birds even in large scale spraying operations. Amphibians and reptiles [79,85] were believed to be seriously affected, although it was assumed that their natural fertility and migration would insure a recovery if the size of the tract treated were not too extensive or too often re-treated. They felt that the native fish, except the speckled trout, chub, and sucker, would not be seriously depleted. The minimum lethal concentration of DDT for these was between 0.01 and 0.005 parts per million. Langford concluded that the invertebrates used by fish as food would be most adversely affected. He recommended that in aerial treatment all streams and lakes be protected from spraying.

In Algonquin Park forest area it was found that one drop of DDT per litre of water was sufficient to kill fish that broke the oil film (DDT) surface of the water and that a considerable portion of the speckled trout population was killed when a shallow forest stream was sprayed. In deeper streams and in more rapid currents, less mortality occurred even at one pound per acre.

In rather extensive areas of Manitoba forests treated with one pound of DDT per acre against spruce budworms, Hoffman, Janson, and Hartkorn [60] attempted to measure the effects on three species of native grouse. Counts were made of adult birds and of broods on sprayed and unsprayed areas before, during, and one year after spraying. Hunters' bags were checked. The authors concluded: "The evidence from all sources, although not of a rigorous nature, agrees with the conclusion that DDT applied at the rate of one pound per acre to control spruce budworms is not immediately harmful to populations of *mountain grouse*".

There is evidence of indirect adverse effects of chlorinated hydrocarbons on woodcock. The birds could have obtained the poison either on the nesting grounds in New Brunswick or the wintering areas in the Gulf Coast States. Wright [139] gives records of 105 woodcock collected in sprayed forest areas and 660 from unsprayed areas between September 20 and No-

vember 4, from 1953 through 1958. The sprayed areas were treated mostly with ½ pound of DDT per acre, but much of the area was treated from one to five times. The results showed a highly significant difference in proportion of young birds collected between sprayed and unsprayed areas, indicating a decrease in the number of young birds produced on the sprayed areas.

Kendeigh [68,69] and Hope [61] concluded from studies in the summer of 1945 in Algonquin Park and in the Black Sturgeon Lake district in Ontario that an application of DDT in an oil spray at the rate of one, three, and five pounds an acre early in May on small areas of spruce-fir forest produced no apparent immediate harmful effect on the birds that were present. An application of DDT in an oil spray at the rate of one pound an acre in late May and June over an extensive area of spruce-fir forest, and which caused an insect kill of 50 to 60 per cent, produced a small, perhaps negligible, direct mortality of birds, but did not affect the size of the total breeding population nor, so far as known, the success in raising the young. Likewise, there was no apparent immediate effect on the resident mammal population. There were between 113 to 167 birds per 100 acres of forest in the spring and a breeding population of 169 to 319 pairs per 100 acres during the summer, a build-up induced by the budworm outbreak. Insectivorous birds (wood warblers) were dominant. Unfortunately, no data could be obtained on the possible effects on succeeding generations.

Speirs [117] found that four pounds of DDT had no appreciable immediate effects on birds; however, repeated and frequent spraying had a marked effect.

Savage [114] concluded that it is unlikely that a stream with a good forest cover receiving spray entirely incidental to normal spraying operations would have the invertebrate life reduced below 60 per cent for a significant length of time. This had been found to be untrue in some areas [64].

Agricultural Spraying

Evidence available indicates that while some damage to wildlife has occurred following pesticide treatment of agricultural lands, these programs in Canada are decidedly less damaging to wildlife than are those in the United States. The rates of application of toxicants often are less in Canada than in the United States. Canada apparently has had neither the need nor the strong encouragement from special interest groups to step up pesticide controls. Possibly, with a smaller and less complex bureaucracy, she may have provided better leadership in directing control programs.

In the United States criticism of pesticide use has been most pronounced with respect to some of the extensive aerial eradication programs under direction of the pest control arm of the U.S. Department of Agriculture and dealing with such pests as fire ants and Japanese beetles. Because high concentrations of very stable, broad spectrum and highly toxic chlorinated hydrocarbons have been blanketed over extensive areas, there is little doubt that serious damage to wildlife resulted. Fortunately, it appears that Canada is much less inclined to embark on extensive eradication programs against insects widely scattered and well established. These are the types of projects, should they be launched, that will likely do the most damage and generate the most opposition to control programs.

The Prairie Provinces of Canada comprise the area most likely to experience an upsurge of control because of the explosive nature of the grasshopper problem. Brown [19] points out that aircraft sprays have been used against grasshoppers since 1945. Use of aircraft is increasing although proportionately there is less airplane use in Canada than in the United States. Folker [40] in 1959, and Chambers [25] in 1960, studied the effects of the use of dieldrin in grasshopper control in two areas in the vicinity of Moose Jaw, Saskatchewan. The outbreaks were relatively minor, and the insecticide was applied only in restricted areas near roadways and fallow areas by property owners. All controls were applied by ground equipment at about the rate of one (1) ounce an acre. In a few instances the rate was much higher. No immediate adverse effects were noted. Folker points out that if control of grasshoppers were to be applied on more extensive areas by aerial spraying, more serious consequences might follow. Certainly the use of dieldrin and its possible effects on wildlife should be the object of thorough and continued study.

In Manitoba, Bossenmaier [16] states that "mass application of toxicants to protect flora from insect damage has not occurred in our (Manitoba) forested or agricultural areas. Primarily, our problem has been grasshopper control on croplands and, so far, chemical formulations and application methods have shown considerable respect for wildlife". He concludes that "there is no evidence that insect poisoning in this province has at any time seriously affected beneficial fauna". He further points out that most grasshopper control is limited to cultivated private lands which are spot treated with low pressure sprayers. His assertion that the application rate used to control grasshoppers is normally one ounce of dieldrin an acre or

three ounces of heptachlor points up a marked contrast with the two pounds (32 ounces) an acre of either of these potent poisons used in most fire ant and Japanese beetle control programs in the United States. Parker [99], in 1952, stated that one to two ounces were recommended for grasshopper control.

Problems of Orchard Insect Control

Programs of orchard spraying are comparatively static and almost all control is carried on locally by the growers themselves, their neighbors, or by their community. In the orchard areas of Nova Scotia particularly, there is a feeling that the increasing use of highly toxic broad spectrum chemical control agents must be used with caution and understanding because of their adverse effect on the natural enemies of the pest species. Economic conditions in other Canadian fruit growing areas are such that different factors may govern decisions regarding the use of pesticides. Nevertheless, the research conducted by Pickett, Patterson, MacPhee, Sanford, Putman, LeRoux, Lord and others [86,87,88,89,90,91,100,101,102,103,104,105] has yielded most suggestive results. From these and other studies it seems that:

(1) The routine repetitive application of widely toxic pesticides, as insurance against outbreaks of arthropod pests, frequently creates, through the destruction of parasites and predators, more serious problems than those corrected.

(2) Several orchard pests presently of great economic importance would not exceed the economic tolerance if pesticides did not interfere with the activities of biotic control agents. Because poisonous toxicants have killed off their natural enemies a number of times, previously unimportant pests have erupted to serious plague proportions (i.e., red mites, rice stink bug, sugar cane borer, predaceous thrips, oyster shell scale, etc.).

(3) Several years may be required for parasites and predators to re-establish themselves, even under favorable conditions, if they have been eliminated over a wide area.

(4) Many pest insects and related arthropods have developed resistance or immunity against one or more groups of pesticides [21,22,23]. This emphasizes the importance of recognizing the role of biological control agents and focuses attention on the desirability of combining biological and specific chemical control.

(5) More emphasis should be placed on the development of selective pesticides, the timing of pesticide applications to avoid susceptible stages of beneficial species, and the establishment of minimum dosages required to control pests. More recognition to cultural practices should be given.

(6) In the long view, it is economically unsound to rely solely on chemical controls. We must make more application of ecology in control.

(7) More precise knowledge of the mechanisms involved in population dynamics is a prerequisite to avoiding complications arising from complete dependence on chemical controls.

(8) Serious pest species often increase more rapidly after a broad spectrum toxic pesticide has been used. For example, Pickett found that codling moths in a Nova Scotia apple orchard increased to plague proportions faster after DDT was used than after ryania had been applied as the control agent.

(9) The principle and importance of biological balance have been clearly demonstrated, and most of the Nova Scotia fruit growers apply this in planning their control programs.

(10) Research should be directed toward developing less toxic and more specific controls as against those that are toxic to broad groups of our fauna.

(11) It is necessary to determine the effects of a chemical on each pest and on beneficial species[62] before it is safe to conclude that in a spray schedule its useful effects sufficiently offset its harmful qualities.

(12) There is urgent need to stress research ahead of mammoth operational programs of chemical control. There is a particular need for research on coordinated control involving both chemical and biological agents.

(13) Resistance is developing among more and more pest species, which makes the use of other methods of control imperative. This emphasizes the need of biological controls and cultural practices that minimize or mitigate against pest species.

In orchard insect control, MacLellan [92,93] found that hairy and downy woodpeckers are both effective in the control of the codling moth in Nova Scotia. They reduced the overwintering larval population on tree trunks by 52 per cent and, in some areas, they reduced the pest insect population in orchards to such a level that other natural control agents were able to prevent the succeeding generation from damaging fruit to an uneconomical degree.

Other Pesticide Uses

Control of the Dutch elm disease has had serious effects on bird life in the United States. In Eastern Canadian cities and towns, scattered spraying to prevent the spread of this serious disease and reduce loss of the majestic elm trees is being practiced on a limited

scale. DDT in very high concentration often is used, and such concentrations have serious effects on attractive city and suburban bird life [131,132,133]. Hickey and Hunt [55,56] concluded that robin populations, for example, would be reduced by not less than 86 per cent within seven to 15 days following treatment. Furthermore, subsequent migrants to these attractive areas likewise would be seriously affected for months and perhaps several years to come. This important problem is in great need of research to develop effective controls that will not be damaging to bird life.

Control of mosquitoes and black flies by DDT sprays is widespread. There has been little research on the effects of these spray programs on wildlife, although they offer good opportunity for such study.

Herbicides

Herbicides are in much greater use both in Canada and the United States than is generally realized, and that use is steadily increasing. As already indicated, Canada, in 1954, used about 3.8 million pounds of herbicides and sprayed more than 11.5 million acres of land at a cost of $4.7 million to control weeds and various underwater plants. As a comparison, Brown [20] reported the U.S. treated 31 million acres at a cost of $48 million during this same period. It is probable this figure referred only to the principal agricultural crop lands and omitted a large and ever-expanding treatment of roadways and other noncrop land. In 1959, the U.S. Department of Agriculture reported (Personal communication from Dr. W.C. Shaw, Leader, Weed Investigations, U.S.D.A., October 25, 1960) that more than 50 million acres of crop lands in the United States were treated with herbicides. But if we include roadsides, utility and railroad rights-of-way, industrial sites, and other non-agricultural areas, we find that 75 million acres or more were treated in 1959, when 11.3 million pounds were used [115].

Relatively few studies of the effect herbicides have on terrestrial wildlife have been conducted. Some damage is known to occur where large doses of toxic herbicides are used, especially in aquatic areas. Used with judgment and skill herbicides have a great value in improving waterfowl marshes [95,120] and in increasing wildlife use of roadways, rights-of-ways, brushy pastures, forest and other lands [5,14,17,45,75,107,140]. These same poisons can also as effectively destroy essential habitat if unwisely used.

There is a vast difference in effectiveness of different herbicides, with their differing chemical formulations, on different species of plants [3,34,43,52,118]. It would be expected that their effects on wildlife and soil organisms would likewise vary greatly. Research certainly is urgently needed to more accurately appraise the immediate and side effects of different herbicides on different groups of wildlife even though it is clear that many of these herbicides have considerable value in making wildlife habitats much more attractive.

Rodenticides

Rodenticides, like other pesticides, affect beneficial wildlife, depending on the way they are used. The public interest at times demands that predatory mammals and rodents be controlled locally. The biggest danger lies in the fact that overenthusiastic control workers, without proper supervision, too frequently do not see the broad public picture and at times carry the control to extremes which adversely affect the biota, including an unnecessary destruction of mammals, birds, and wildlife generally [28,108,116]. I have seen no evidence that this problem has become serious in Canada. As with all other control programs, the use of rodenticides should be carefully evaluated.

Biological Controls

Biological controls have been eminently successful in some instances and this approach to the pesticide problem should be pursued with vigor. Canada is doing outstanding work in this field as evidenced by the splendid papers by Angus and Heimpel on bacterial control of pest insects [6,7,8,9,10,48,49,50,51,58,96]. Similar important studies also are conducted at the University of California and elsewhere [54,112,113,121,122,123,124,125,126,127,128,129].

References

[1] Anonymous. *Sales of pest control products by Canadian Registrants.* Dominion Bureau of Statistics, Ottawa. 1947 to 1959 (annually).

[2] *The hazards of broadcasting toxic pesticides.* Nat' l. Audubon Society. New York. 1958. pp 16.

[3] *Weed control with chemicals.* (Published by authority of Minister of Agriculture of Saskatchewan). Regina. 1959. pp. 16.

[4] *Interim report on the effects of DDT on resident coho fry populations of Moresly Island streams.* Dept. of Fisheries, Pac. Area, Vancouver, B.C. 1960.

[5] Allen, Durward L. *Wildlife habitat in relation to the use of herbicide sprays on farms, ranches, and roadways.* Proceedings, Int. Assn. Game, Fish and Cons. Comm. 43:90-94. 1953.

[6] Angus, T.A. and A.M. Heimpel. *The bacteriological control of insects.* Proc. Ent. Soc. Ont. 90:13-21. 1959.

[7] *Inhabition of feeding and blood pH changes in Lepidopterous larvae infected with crystal-forming bacteria.* Can. Ent. 9(16): 352-358. 1959.

[8] (Ms. to be published) *The bacterial control of insects.* Dom. Lab of Insect Pathology, Sault Ste. Marie, Ontario.

[9] (Ms. to be published) *Microbiological control of forest insects as a new approach.* Dom Lab. of Insect Pathology, Sault Ste. Marie, Ontario.

[10] Angus, T.A. *Microbiological control of forest insects as a new approach.* Ms. 5th World Forestry Congress (Sault Ste. Marie, Ont). 1960. pp. 7.

[11] Balch, R.E., F.E. Webb and J.J. Fettes. The use of aircraft in forest insect control. Reprint from Forestry Abstracts. No. Vol. 16. 4, 1955 and Vol. 17, No. 1 and 2. 1956. Commonwealth Agr. Bureaux, Farnham Royal, England. 1956. pp. 31.

[12] Ball, W.L., Kingsley Kay and J.W. Sinclair. Observations on the Toxicity of aldrin. *Jour Am. Med. Assn.*, Archives of Ind., Hygiene and Occup. Med. 7: 292-300. 1953.

[13] Ball, W.L. Pesticides—boon or menace. *Canadian Services Med. Jour.* 11: 96-100. 1955.

[14] Beck, Robert. Herbicides increase game foods and edge in solid stands of phragmites. *Down to Earth,* Summer, Dow Chem. Co., Midland, Michigan. 1957.

[15] Bergen, Stephen W. *Ecology and Chemical pesticides.* Conser. Fdn., New York, N.Y. 1960. pp. 34.

[16] Bossenmaier, Eugene F. *The effects of insecticides upon wildlife.* Presented before the Manitoba Ent. Soc. Manitoba Game Branch, Winnipeg. 1959. pp. 13.

[17] Bramble, W.C., W.R. Byrnes and R.J. Hutnik. *Effects of chemical brush control upon game food and cover.* College of Agr., Pa. State Univ. Univ. Park, Pa. Progress Report. 1958.

[18] Briggs, Shirley A. *Pesticide campaigns and the encephalitis scare.* At. Nat. 15(2)93-97. 1960.

[19] Brown, A.W.A. *Insect control by chemicals.* John Wiley & Sons, Inc., N.Y. 1951. pp. 817.

[20] *Survey of commercial application of agricultural chemicals in Canada.* Dept. of Agr., Sci. Serv., Ent. Div. Ottawa. 1956. pp. 45.

[21] Insecticide resistance as a world problem. *Can. Jour. Biochem. Physiol.* 37: 1091-1096. 1959.

[22] *Biol. consequence of the development of resistance.* Ms. for publication. Univ. of Western Ont., London, Ont. 1960.

[23] *The effect of chemical control of insects on wildlife conservation.* Ms. to be published. Ent. Soc., Ontario. 1960.

[24] Brown, G.S., A.P. Randall, R.R. Lejeune and G.T. Silver. Blackheaded budworm spraying experiments on Vancouver Island, B.C. *The Forestry Chronicle* 34 (3):299-306. 1958.

[25] Chambers, Kenneth J. *Follow-up on dieldrin investigations in Saskatchewan.* Dept. of Nat. Resources, Regina, Saskatchewan. 1960.

[26] Clawson, Sterling G. and Maurice F. Baker. Immediate effect on dieldrin and heptachlor on bobwhites. *Jour. Wildl. Mgt.* 23(2): 215-219. 1959.

[27] Committee Report. Pesticides and wildlife. *Proc., Int. Assn. Game, Fish and Cons. Comm.,* 49:82-89. 16413 Canterbury Drive, Hopkins, Minnesota. 1959.

[28] Pesticides and wildlife. *Proc., Int. Assn.Game , Fish and Cons.* Comm., 50:53-61. 16413 Canterbury Drive, Hopkins, Minnesota. 1960.

[29] Cottam, Clarence. Effects of pesticides on aquatic life. Summary of panel discussion. *Trans. of 1959 Seminar on Biology, Problems in Water Pollution.* U.S. Publ. Health Serv., Taft Sanitary Eng. Center, Cincinnati, Ohio. 1959. pp. 102-105.

[30] Cottam, Clarence, Pesticides and Wildlife. *Proc., Ninth Annual Tex. Agr. Aviation Conf.,* A. and M. College of Tex., College Station, Texas. 1960. pp. 16.

[31] Pesticides, chemicals and pollution. *Proc., Nat. Conf. on Water Pollution.* and To be published. U.S. Publ. Health Serv., Wash., D.C. 1960. pp. 12.

[32] Cope, Oliver B. and Paul F. Springer. Mass control of insects: The effects on fish and wildlife. *Bull. of Ent. Soc. of Am* 4(2): 52-56. 1958.

[33] Crouter, R.A. and E.H. Vernon. Effects of black-headed budworm control on salmon and trout in British Columbia. *The Canadian Fish Culturist.* Issue 24, Feb. Ottawa, Ont. 1959. pp. 23-40.

[34] Danielson, L.L., W.A. Gentner and W.C. Shaw. *A secondary field evaluation of several new herbicides (1959).* Progress and Preliminary Report. Wash., D.C. U.S.D.A. 1960. pp. 14.

[35] Darsie, Richard F., Jr. and Paul F. Springer. *Three-year investigation of mosquito breeding in natural and impounded tidal marshes in Delaware.* Univ. Delaware, Agr. Exper. Sta., Newark. 1957. pp. 65.

[36] DeWitt, James B. Chronic toxicity to quail and pheasants of some chlori-

nated insecticides. *Jour. of Agr. and Food Chem.* 4(10): 1956. pp. 863-866.

[37] DeWitt, James B. and John L. George. *Pesticide-wildlife review of direct effects of pesticides on field populations.* Circular 84, Bureau of Sport Fisheries and Wild., Wash. D.C. 1960.

[38] DeWitt, James B., C.M. Menzie, V.A. Adomoites and William L. Reichel. *Pesticide residues in animal tissue.* U.S. Bureau of Sport Fisheries and Wildl., Wash. D.C. 1960. pp. 22.

[39] Ennis, W.B. Jr. *Use of Herbicides, growth, regulators, nematocides and fungicides.* Symposium, A.R.S.-20-9, U.S.D.A., 1960. pp. 17-27.

[40] Folker, Robert V. *A study of the effects of dieldrin spraying on wildlife* (1959). Dept. of Nat. Resources, Regina, Saskatchewan. 1960.

[41] Fettes, James J. *Forest aerial spaying—dosage concepts and avoidance of hazard to fish and wildlife.* 5th World Forestry Congress, Seattle, Wash. (Ms. Ottawa). 1960. pp. 11.

[42] Gannon, Norman and G.C. Decker. Insecticide residues as hazards to warm-blooded animals. *Proc., 24th No. Am. Wildl. Conf., Wildl. Mgt. Inst.*, Wash., D.C. 1959. pp. 124-129.

[43] Gentner, W.A. and W.C. Shaw. *An evaluation of several chemicals for their herbicidal properties (1958). Plant Industry,* Beltsville, Md. Progress and Preliminary Report. Processed. 1959. pp. 72.

[44] George, John L. Effects on fish and wildlife of chemical treatments of large areas. *Jour. of Forestry* 57 (4): 250-254. 1959.

[45] Gysel, Leslie. Effects of different methods of releasing pine on wildlife food and cover. *Down to Earth,* fall issue, Dow Chem. Co., Midland, Michigan. 1957.

[46] Hale, Roger D. *Aerial spraying plus and minus.* Pulp and Paper. Conserv. Fdn., New York. 1959. pp. 154-157.

[47] Hargraves, M.M. Pesticides and human health. *Proc., Nat. Wildl. Federation,* Wash., D.C. 1959.

[48] Harkness, Douglas S. *Report of the Minister of Agriculture.* Annual Report. Canada Dept. of Agriculture. Ottawa, Ont. 1958.

[49] Heimpel, A.M. Investigations of the mode of action of strains of *Bacillus cereus.* Pathogenic for the larch sawfly. *Can. Jour. of Zoology* 33: 311-326. 1955.

[50] Heimpel, A.M. and T.A. Angus. Recent advances in the knowledge of some bacterial pathogens of insects. *Proc. 10th Int. Cong. of Ent.* 4:711-727 (1956). 1958.

[51] Bacterial insecticides. *Bacteriological Review* 24(3):266-288. 1960.

[52] Hemphill, Delbert D., G.F. Friesen, et al (a large Committee). *Summary of research findings at the North Central Weed Control Conference.* Dept. of Plant Science, Univ. of Manitoba, Winnipeg or Univ. of Mo., Columbia, Mo. 1958. pp. 12.

[53] Henderson, Croswell, Q.H. Pickering and C.M. Tarwell. The toxicity of organic phosphorus and chlorinated hydrocarbon insecticides to fish. *Trans. of 1959 Seminar on Biological Problems in Water Pollution,* pp. 76-88. U.S. Publ. Health Serv., Taft Sanitary Eng. Center, Cincinnati 26, Ohio. 1959.

[54] Hepting, George H. *Climate changes and forest diseases.* 5th World Forestry Congress, Wash. D.C. U.S.D.A. 1960. pp. 8.

[55] Hickey, Joseph J. and L. Barrie Hunt. Initial songbird mortality following a dutch elm disease control program. *Jour. Wildl. Mgt.* 24 (3):259-265. 1960.

[56] Songbird mortality following annual programs to control dutch elm disease. *Atlantic Naturalist* 15(2): 87-92. 1960.

[57] Hoffman, Clarence H. Are the insecticides for insect control hazardous to aquatic life? *Trans. of 1959 Seminar on Biological Problems in Water Pollution.* Pages 51-61. U.S. Publ. Health Serv., Taft Sanitary Eng. Center, Cincinnati 26, Ohio. 1959.

[58] *Biological control of noxious insects and weeds.* Processed. Nat. Wildl. Federation, Wash. D.C. 1959. pp. 13.

[59] Aerial application of insecticides in relation to fish and wildlife. *Proc., 9th Annual Nebraska Aerial Applicators Short Course.* Norfolk, Neb. 1960. pp. 38-55.

[60] Hoffman, Robert S, Reuel G. Janson and Fred Hartkorn. Effects on grouse populations of DDT spraying for spruce budworm. *Jour. Wildl. Mgt.* 22(1):92-93. 1958.

[61] Hope, C.E. *Effect of DDT on birds and the relation of birds to the spruce budworm.* Dept. of Lands and Forests, Div. of Research. Biol. Bull. No. 2, Toronto, Ont, Canada. 1949. pp. 57-62.

[62] Hueck, H.J. The population dynamics of the fruit tree red spider with special reference to the influence of DDT. Proefsehr, Rijksunir, Leiden. Cited in *Rev. Appl. Ent.*, A 43:34D. 1953.

[63] Hunt, E.G. and A.I. Bischoff. Inimical effects on wildlife of periodic DDT applications to Clear Lake. *California Fish and Game* 46(1): 91-106. 1960.

[64] Ide, E.P. Effect of forest spraying with DDT on aquatic insects of salmon streams. *Trans. Am. Fisheries Soc.* 86: 208-209. 1956.

[65] Jackson, K.J. *Field experiments to determine the effects of aerial applications of benzene hexachloride upon coho salmon fry.* Ms. processed, to be published. Dept. of Fisheries, Pac. area, Vancouver, B.C. 1960.

[66] Keenleyside, Miles H.A. Effects of spruce budworm control on salmon and other fisheries in New Brunswick. *The Canadian Fish Culturist.* Issue 24, February 1959. pp. 17-22.

[67] Insecticides and wildlife. *Canadian Audubon* 21(1):1-7. 1959.

[68] Kendeigh, S. Charles. The effect of DDT on bird and mammal population in the spruce-fir forest of Canada. *Research Bull.* No. 1. April-July, 1945. Dept. of Lands and Forests, Toronto, Ont., Canada. 1946. pp. 100.

[69] Kendeigh, S. Charles. *Bird population studies in the Coniferous Forest Biome during a spruce budworm outbreak.* Dept. of Lands and Forests, Toronto, Ontario. 1947.

[70] Kerswill, C.J. Effects of DDT spraying in New Brunswick on future runs of adult salmon. *The Atlantic Advocate* 48 (8): 65-68. 1958.

[71] Kerswill, C.J. and P.F. Elson, Preliminary observations on effects of 1954 DDT spraying on Miramichi Salmon stock. *Progress Report of the Atlantic Coast Station of the*

Fisheries Research Board of Canada. Issue No. 62, July 1955. pp. 17-24.

[72] Kerswill, C.J., P.F. Elson, M.H.A. Keenleyside and J.B. Sprague. Effects on young salmon of forest spraying with DDT. *Trans. of 1959 Seminar on Biological Problems of Water Pollution.* U.S. Publ. Health Serv., Taft Sanitary Eng. Center., Cincinnati, Ohio. 1960.

[73] Kinghorn, J.M. and Associates. *Preliminary report on black-headed budworm control projects.* Queen Charlotte Islands, 1960. Dept. of Fisheries, Pac. Area, Vancouver, B.C. 1960. pp. 8.

[74] Knipling, E.F. *Use of insecticides, attractants and repellents.* Symposium, A.R.S. 20-9, U.S.D.A. 1960. pp. 28-36.

[75] Krefting, Laurist W. *Effects of cutting mt. maple on the production of deer browse.* School of Forestry, Univ. of Minn., St. Paul 1, Minn. with co-operation U.S. Bur. of Sport Fisheries and Wildl, and Div. Forestry, Minn. Cons. Dept. 1953.

[76] Kverno, Nelson B. The problems in the use of systemic rodenticides. *Proc. Soc. of Am. Foresters.* 1959. pp. 97-98.

[77] Langford, R.R. *Effects of DDT on freshwater fishes.* Research Report No. 8, 11-38. Ontario fisheries research lab. Univ. of Toronto, Toronto, Ontario. 1946.

[78] *The effects on aquatic life of DDT, as sprayed on a forest area in the Port Arthur Distict.* Research Report No. 8:39-41. Ontario Fisheries Research Lab, Univ. of Toronto. 1946.

[79] Langford, R.R. The effect of DDT on the natural fauna of the forest exclusive of insect pests, 1944. *Res. Biol. Bull.* No. 2, pp. 13-19, Dept. of Lands and Forests, Toronto, Ontario. 1949.

[80] The effect of DDT on freshwater fishes, 1944-45. *Res. Biol. Bull.* No. 2, Dept. of Lands and Forests, Toronto, Ontario. 1949. pp. 19-38.

[81] Lay, Daniel W. Count three for trouble. *Tex. Game and Fish* 16(7): 4-7 Austin, Tex. 1958.

[82] Lay, Daniel W. Aftermath of waste. *Texas Game and Fish 17* (10): 16-19. Austin, Tex. 1959.

[83] Leake, Chancey D. *Proceedings of a symposium on problems of toxicity.* Fed. of Am. Soc. for Exper. Biol. Waverly Press, Baltimore, Maryland. 1960.

[84] Lejeune, R.R. Spraying operation for control of the black-headed budworm, Vancouver, British Columbia. 1957. *Proc. Ent. Soc. of B.C.* 56:16-18. 1959.

[85] Logier, E.B. Shelley. Effect of DDT on amphibians and reptiles. *Res. Biol. Bull. No.* 2 pp. 49-56. Dept. of Lands and Forests, Div. of Research, Toronto, Ontario. 1949.

[86] Lord, F.T. The influence of spray programs on the fauna of apple orchards in Nova Scotia. 2. Oystershell Scale. *Can. Ent.* 79:196-209. 1947.

[87] The influence of spray programs on the fauna of apple orchards in Nova Scotia. 3. Mites and their predators. *Can. Ent.* 81, No. 9. 1949. pp. 27.

[88] The influence of spray programs on the fauna of apple orchards in Nova Scoita. IX. Studies on means of altering predator populations. *Can. Ent.* 88(3): 129-137. 1956.

[89] MacPhee, A.W. The influence of spray programs on the fauna of apple orchards in Nova Scotia. V. The predaceous thrips *Haplothrips faurei Hood* 85(1):33-40. 1953.

[90] MacPhee, A.W. and K.H. Sanford. The influence of spray programs on the fauna of apple orchards in Nova Scotia. VII. Effects on some beneficial arthropods. *Can. Ent.* 86(3): 128-135. 1954.

[91] The influence of spray programs on the fauna of apple orchards in Nova Scoita. X. Supplement to VII. Effects on some beneficial arthropods. *Can. Ent.* 88 (2): 631-634. 1956.

[92] MacLellan, C.R. Role of woodpeckers in control of codling moth in Nova Scoita. *Can Ent.* 90(1): 18-22. 1958.

[93] Woodpeckers as predators of codling moth in Nova Scoita. *Can Ent.* 91 (11):673-680. 1959.

[94] Mackie, R.E. The effect of DDT on mammals. *Res. Biol. Bull.* No. 2, pp. 63-70. Dept. of Lands and Forests, Toronto, Ontario. 1949.

[95] Martin, Alex. C. and Ray C. Erickson. *Improving duck marshes by weed control.* Circ. No. 19 Revised, U.S. Govt. Printing Office. Wash. D.C. 1957. pp. 60.

[96] McGugan, Blair M. *Biological control of forest insects-the role of parasites and predators.* Ms., 5th World Forestry Congress (Ottawa) 1960. pp. 8.

[97] Mills, Harlow B. 1959- Pest control in the modern setting. *Proc. 24th North Am. Wildl. Conf. Wildl. Mgt. Inst.,* Wash., D.C. 1959. pp. 113-117

[98] Mohr, R.W., H.S. Telford, E.H. Peterson and K.C. Walker. *Toxicity of orchard insecticides to game birds in eastern Washington State,* Circ. No. 170. Wash. State Dept. of Game and Agr. Exper. Sta., State College, Pullman. 1951 pp. 22.

[99] Parker, J.R. Grasshoppers, *U.S.D.A. Yearbook—Insects* U.S. Govt. Printing Office, Wash., D.C. 1952. pp. 595-605.

[100] Pickett, A.D. *The philosophy of orchard insect control.* 79th annual report, Ent. Soc. of Ont, Reprint. 5 pp. Cont. 2589, Div. Ent. Sci. Serv., Dept. Agr., Ontario. 1948.

[101] Controlling orchard insects. *Agr. Inst. Review,* March-April Dept. Agr., Ottawa, Canada. 1953.

[102] Utilization of native parasites and predators. *Jour. Econ. Ent.* 52(6): 1103-1105. Also reprinted in Atlantic Naturalist 15(4): 254-260. 1959.

[103] *Effects of disease and insect control practices on biological balance in apple orchards. Biol. and Chem. Control of Plant and Animal Pests.* Am. Assn. for the advancement of Sci., Wash., D.C. 1960. pp. 201-208.

[104] Pickett, A.D. and N.A. Patterson. The influence of spray programs on the fauna of apple orchards in Nova Scotia. IV. A Review. *Can. Ent.* 85(12): 472-477. 1953.

[105] Pickett. A.D., Wm. L. Putman and E.J. LeRoux. Progress in harmonizing biological and chemical control of orchard pests in eastern Canada. *Proc. Int. Congress of Ent. 1956.* 3:169-174. Canada Dept. of Agr., Ottawa, Canada. 1958.

[106] Rosene, Walter. Whistling cock count of bobwhite quail on areas treated with insecticides and untreated areas. *Proc. 12th Annual Conf. S.E. Assn. Game, Fish and Cons.* Comm., Columbia S.C. 1958. pp. 5.

[107] Ruch, Lewis C. *Vegetative control problems in wildlife habitat as they pertain to upland game.* Mich. Dept. of Cons., Lansing Mich. File No. H.G.-36, P-R Report. Processed. 1956. pp. 4.

[108] Rudd, Robert, L. and Richard E. Genelly. *Pesticides, their use and toxicity in relation to wildlife.* Dept. of Game and Fish, Bull No. 7, Univ. of Calif., Davis 1956. pp. 209.

[109] Rudd, Robert L. *The indirect effects of chemicals in nature.* Nat. Aud. Soc., 1130 Fifth Ave., N.Y. 1958. pp. 5.

[110] Pesticides: the real peril. *The Nation,* 188: 399-401. 1959.

[111] Rudd, Robert L. The irresponsible poisoners. *The Nation,* 188(22): 485-487. 1959.

[112] Rudinsky, J.A. *Chemical control of forest insects: new approaches. including systemics.* Ms., 5th World Forestry Congress (Oregon State College), Corvallis, Oregon. 1960.

[113] Ruppertshofen, Heinz. Biological forest protection by birds. Ms., 5th World Forestry Congress. *Red forest ants and forest spiders.* Seattle, Wash. 1960.

[114] Savage, James. *Aquatic invertebrates: mortality due to DDT and subsequent re-establishment.* Biol. Bull. No. 2, Dept. of Lands and Forests. Toronto, Ontario. 1949. pp. 39-47.

[115] Shepard, Harold H., John N. Mahan and Charlotte A. Graham. *The pesticide (U.S.) situation for 1958-59.* U.S.D.A., Wash., D.C. 1959. pp. 24.

[116] Smelser, Marguerite A. Uncontrollable "control". *Nature Magazine.* Wash., D.C. 1959. pp. 10.

[117] Speirs, J. Murray. *The relation of DDT spraying to the vertebrate life of the forest.* Biol. Bull. No. 2, Dept. of Lands and Forests, Toronto, Ontario. 1949. pp. 141-148.

[118] Springer, Paul F. *effects of herbicides and fungicides on wildlife.* North Carolina Pesticide Manual, North Carolina State College, Raleigh, N.C. 1957. pp. 87-106.

[119] Mosquito control and wildlife management. *Proc. Fourth Am. meeting, Ill. Mosquito Control Assn.* U.S. Bur. Sport Fisheries and Wildlife. 1958. pp. 55-62.

[120] Stiles, W.B. Summary of weed control on national wildlife refuges. *Proc., U.S. Bur. Sport Fisheries and Wildlife.* 1960. pp. 63.

[121] Steinhaus, Ed. A. Infectious diseases of insects. *U.S.D.A. Yearbook.* Wash., D.C. 1952. pp. 388-394.

[122] Potentialities for microbial control of insects. *Agr. and Food Chem.* 4(8): 676-680. 1956.

[123] Microbial control — the emergence of an idea. *Jour. Agr. Sci.,* Calif. Agr. Exper. Sta., Berkeley, Calif. 26(2): 107-160. 1956.

[124] Microbial diseases of insects. *Annual Review of Microbiology.* 165-182. 1956. pp. 165-182.

[125] *New horizons in insect pathology.* N.Y. Ent. Soc. 65: 113-121. 1957.

[126] Steinhaus, Ed. A. Bacteria as microbial control agents. *Trans. I. Int. Conf. Insect Pathology and Biological Control,* Dept of Biological Control, Univ. of Calif., Berkeley 2, Californa. 1958.

[127] Insect pathology: challenge, achievement, and promise. *Bull. Ent. Soc. of Am* 6(1):9-16. 1960.

[128] Tanada, Y. Microbial control of insect pests. *Annual Review of Ent.* 4:277-302. 1959.

[129] Voute, A.D. *Cultural control of forest insects.* 5th World Forestry Congress. Ms., Seattle, Wash. 1960.

[130] Walker, Charles R. Herbicides. *Trans. of Seminar on Biological Problems in Water Pollution.* Page 272. U.S. Publ. Health Serv. Taft Sanitary Eng. Center, Cincinnati 26, Ohio. 1959.

[131] Wallace, George J. Insecticides and birds. *Audubon Magazine* 61(1): 10-12 and 35. New York. 1959.

[132] Some biological effects of insecticides on non-target organisms. *Carolina Tips* 22(8):29-32. 1959.

[133] Another year of robin losses on a university campus, *Audubon Magazine* 62(2):66-69. 1960.

[134] Warner, Kendall and Owen C. Fenderson. *Effects of forest insect spraying on northern Maine trout streams.* D.J. Project F-7-R-7. Processed, Maine Dept. of Inland Fisheries and Game. Augusta, Maine. 1960. pp. 32.

[135] Webb, F.E. *Biological assessment of aerial forest spraying against spruce budworm in New Brunswick. II. A review for the period 1952-1956.* Cont. No. 371, Forest Biol. Div., Sci. Serv., Dept. of Agr., Proc. 10th Int. Congress of Ent. 4:303-316. 1958.

[136] Aerial forest spraying in Canada in relation to effects on aquatic life. *Trans. of 1959 Seminar on Biological Problems in Water Pollution.* U.S. Publ. Health Serv., Taft Sanitary Eng. Center, Cincinnati 26, Ohio. 1959. pp. 66-70.

[137] Aerial chemical control of forest insects with reference to the Canadian situation. *The Canadian Fish Culturist* No. 24, February. 1959. pp. 3-16.

[138] Westlake, W.E. and J.P. San Antonio. *Insecticide residues in plants, animals, and soils.* A.R.S. 20-9, U.S.D.A., 1960. pp. 105-115.

[139] Wright, Bruce S. Woodcock reproduction in DDT sprayed areas of New Brunswick. *Jour. Wildl. Mgt.* 24(4): 419-420. 1960.

[140] Zorb, Gordon L., Lewis Ruch and Robert G. Health. *Chemical Seedbed preparation for game food patches* (P-R Report W-40-R and W-36-D), File No. HB-39, Mich. Dept. of Conservation. 1958. (?) pp. 7.

Elements of a Wildlife Policy

W. Winston Mair,
Chief, Canadian
Wildlife Service,
Ottawa.

Policy is construed to refer to strategy; it lays down objectives, priorities and time scale. It sets out in general terms the money, manpower, and resources available for the wildlife program.

The objective of wildlife policy is to ensure that wildlife contributes in the fullest sense to the broader program of renewable resource use, to the welfare of persons living off the land, and to the enrichment of scientific and cultural growth of our nation. It is proposed there should be undertaken a study to determine what the wants of the nation are for wildlife (and recreation) and how far governments should go in meeting those needs.

The wildlife resources of Canada are rich and varied, but in their use wilfull waste must be avoided. Exotics may be considered where biological vacuums exist. Planned programs for the use of land and water are basic to the maintenance of wildlife species. Not only must specific environments be maintained to perpetuate wildlife, but significant areas of Crown lands must be set aside for public hunting, fishing, and associated recreational activities. Some means of encouraging production of wildlife and its harvest on private lands must be found if hunting and fishing are to persist as significant elements in the life of the average Canadian.

Present systems of financing wildlife research and management are inadequate, in large measure because they rely solely on returns from sales of licences. The basic program for maintenance of wildlife should be financed from general revenue. The program for production of surpluses should be supported by licence or tax on special users, and businesses based on exploitation of the resource. The federal government has both legislative and other interests in wildlife and should contribute significantly to research and management programs.

Wildlife management (including research) combines science and art and demands a high standard of training and personal qualifications from those engaged in it. Research programs in each region should be related to the university activities in the area to encourage promising students to go into the field. Game wardens or conservation officers are required to undertake increasingly complex technical duties, while maintaining public contact and traditional long hours of work over rough terrain. Within ten years a diploma course in wildlife management, from technical college or university, should be a prerequisite to employment as a game warden. Executive or senior administrative staff must have training and qualifications that will permit adequate direction and co-ordination of research, management, enforcement, and public relations activities.

The needs set forth are urgent. Policy decisions to meet them must be made within the next five years and programs of implementation commenced within ten years, or destructive exploitation of our wildlife resources will occur under the rapidly increasing tempo of utilization. Recovery then will be painfully slow and costly.

Finally, it is apparent that bold policies resulting in imaginative, constructive programs can only be set if the public fully understands and supports them. There is an urgent need for some form of citizen's organization in Canada to ensure that the public may have at hand the facts and ideas on which they may make adequate value judgments respecting policies and programs. In particular, we must ensure that the wildlife resource retain its socio-psychological benefits in the face of intensive utilization and management.

93452—61½

Wildlife may be considered broadly to include all animal life occurring in the wild state, but it usually refers to the vertebrates (fish, amphibians, reptiles, birds, and mammals). However, as vertebrates depend on land and water, and are but one facet of the earth's living complex, their management is directly concerned with land and water, as well as other animal and plant life.

It is well, in considering wildlife policies, to delineate the boundaries of *policy* as opposed to *management*. Hooper[1] has outlined the situation as follows: "It is the task of policy to lay down strategy: to assign objectives, establish priorities, and set the time scale. It is a part of policy to lay down the broad limits in money, manpower, and resources generally, within which the program must be carried through. It is the task of management to carry policy into effect with the fullest efficiency within the limits assigned: ...to create conditions which will bring about the optimum use of all resources available...". Hooper recognized, of course, that management and policy react on and tend to modify one another all the time.

Clarke[2] has made a case for the economic and social values of wildlife vis-à-vis other resources of our country. It is important to reiterate, however, that wildlife values touch upon every facet of our well-being and are not exclusively the concern of hunters and fishermen. An adequate understanding of that point is essential to intelligent consideration of policies guiding development of the resource.

The Objectives of Wildlife Management

The objective of wildlife management might be stated, in broadest terms, thus: to ensure that wildlife contributes in the fullest sense to development of the earth's life complex, to be used and enjoyed by mankind now and forever.

It is an indication of the essential unity of the conservation ethic that the Soil Conservation Society of America recently published the following statement: "The objectives of this Society shall be the development and advancement of the science and art of good land use and management and the promotion of conservation of soil, water and related renewable natural resources including, without limitations, trees, grass, fish, wildlife, and all other forms of benefical plant and animal life and for these purposes to employ education of the people and other appropriate means to the end that mankind may have the use and enjoyment of these resources forever."[3]

More specifically, the following objectives are proposed:

(1) To maintain all species from extinction for their own intrinsic value and for their scientific and esthetic values that may prove important in human survival.

(2) To maintain species and populations in optimum numbers required to protect ecological situations, including those created by man for his own food and welfare.

(3) To maintain wildlife populations for the use of our indigenous peoples and others choosing to live *on the land*.

(4) To maintain fish and wildlife populations to meet recreational needs now and in the future, and in particular to maintain harvestable surpluses so that hunting and fishing may remain a significant factor in our cultural and recreational heritage.

The emphasis is on use, as a positive approach to the maintenance of a dynamic resource.

Objectives 1 to 3, though least well known and understood by the public generally, are not difficult to understand. Objective number 4 is well known to many Canadians but is probably no better understood in detail than the other objectives. It is the subject of much controversy, because of the varying and even conflicting interests of our people. As well, the very values we seek to maintain in providing for recreational needs – wildness, wilderness conditions, and contact with the outdoors – can be destroyed by an overly intensive management of the resource. Wildlife, unlike other renewable resources, can contribute to our well-being in full measure only to the extent that its patterns of use are kept *viable*, in a socio-psychological sense, in the face of intensifying management and utilization.

In considering objectives, we face the fact that beyond the needs for mere survival "...wants are created, and not original within the individual..."[4] In wildlife and recreation, public demand is undoubtedly stimulated by, among others, resort operators, sporting goods manufacturers, and even some government agencies. Johnson[4] stated that it is a "...fundamental, philosophical problem whether the satisfaction of wants created by those who satisfy them can be regarded as social gain." He believes that it can be, because there are standards for judging good from bad, and there are social and governmental processes to protect the public interests. But social gain can result only if public information and understanding provides an adequate basis for judgment. If, in the management of wildlife, that understanding is long in development, and pre-

cious values are irretrievably lost, how shall we be judged, and who but our descendants shall pay the penalty? More will be said later of public education, but there is clearly a requirement for courageous, imaginative *leadership* in the development of our wildlife resource. *As a matter of policy, studies should be undertaken at every level of government to determine desirable modes and levels for use of wildlife, and* where *and* how far *governments should go in meeting the wants being created in the wildlife field.* If this is not done, we may well make the resource but one more *amusement,* to be discarded at whim, rather than a rich contribution to our way of life.

The Resources to be Used

Wildlife

Canada has a rich fauna, which should be maintained intact as a part of our heritage. However, as a natural life process, many wildlife species produce each year a surplus of offspring to meet the contingencies of harsh existence, so that when each reproductive period begins there are approximately the same total number as before. Given good conditions, total numbers may increase; given poor conditions they may decrease. Where adequate surpluses exist, and favorable conditions prevail, there is no biological reason why those surpluses should not be harvested by man. What species shall be harvested thus becomes an ethical and cultural matter, to be decided by the public at any particular point in time. Similarly, the means of harvest will be decided by cultural influence, since it makes no difference to the species how the surplus is used. *As a matter of policy, however, no (non-injurious) game taken should be wilfully wasted, since such is offensive, not only to Canadians, but to people throughout the world.*

Where biological vacuums exist, the introduction of exotic species may be carefully considered. If hunting pressure is heavy, exotics may supplement the hunting opportunity provided by indigenous species, particularly where agricultural practices necessarily reduce the numbers of the latter. *It should be a matter of policy, however, that no exotic should be permitted that may replace and force into extinction indigenous species of our fauna should be permitted.*

Land and Water

Land and water, air and sunshine, are the basic essentials for plant life, without which there can be no wildlife. Every wildlife species has its own specific requirements, its ecological niche, beyond which it cannot flourish and may not survive. If wildlife species are to be maintained, there must, therefore, be carefully planned land use programs. If surpluses for hunting and fishing are to be available, certain additional land requirements must be met, and planning becomes of even more importance. Like any other product of the land, wildlife grows most abundantly on the richest lands. It will not suffice to dedicate to wildlife use only those lands that are of no value for any other purpose.

A secondary but important factor is the need for land upon which the public may hunt and fish and enjoy other recreation associated with the wild. Here is met a problem arising from two traditions: land as private property, and wildlife as property of the Crown. I believe that Canadians will wish to preserve both traditions, but each may require some modification.

As a matter a policy, then, it is proposed that:

(1) Consistent with the basic purposes for which they are set aside, all federal lands should be managed for wildlife, in harmony with the basic plan for each province or territory.

(2) Significant areas of provincial Crown lands should be retained from alienation, or land should be acquired by the Crown, to produce wildlife for hunting, fishing, and associated recreation, and to provide public grounds for those pursuits. In multiple-land-use planning, provision should be made for areas where wildlife will be the primary resource and all other uses will be regulated to protect that primary use.

(3) The right of public access, for purposes of hunting, fishing, and other associated recreational pursuits, should be maintained for all leased Crown lands under some form of regulation consistent with the major use of those lands.

(4) Some form of recompense for private landowners should be devised, in order that their lands may produce wildlife to full capacity and be made available to the public under regulation. This need not necessarily be in the form of a government subsidy or similar payment.

No other way is seen for hunting, fishing, and associated outdoor recreation to be maintained as the human population increases both here and in the United States.

The Money Required

The present system of financing wildlife management is quite inadequate and will become more so as pressures on the resource increase. Present programs of land and water management are particularly inadequa-

te, and research is insufficient to meet needs of inventory and intensive management. Staffs are in general too small to meet the growing demands for recreation. All this is not surprising when one considers the patterns of present and future use outlined by Clarke.[2]

The amount of money spent annually in hunting and fishing, i.e. injected into the economy, might be compared favorably with the market value of all commercial fish landed in Canada. Yet for commercial fisheries the Federal Government alone spends about 20 million dollars annually on administration, research and management, while all agencies, federal and provincial, in the sport fish and wildlife field spend only about 10 million dollars annually.

Data on revenue and expenditure of game administration given by Munro[5] suggest that, in financing sport fish and wildlife management, it is common practice to strike a rough balance between direct revenue and expenditure. This practice fails completely to recognize the actual contribution of the resource to the economy, and the stake of every citizen in it. It places the burden almost entirely upon the *special users* who represent less than 20 per cent of the Canadian population. It fails also to direct proportionately to the resource the taxes paid by those whose businesses depend on it. As a consequence, management of sport fish and wildlife receives inadequate financial support.

It is proposed as a matter of policy that:

(1) The general interest in wildlife, as related to general recreation, esthetic enjoyment, photography, bird watching, maintenance of healthy biotic communities (e.g. for insect control, rodent control, etc.), should be maintained through programs financed from general revenue. Land manipulation and protection, regulation and research basic to those purposes should be so financed.

(2) Programs to provide harvestable surpluses of wildlife should be financed through tax upon special users, and upon persons benefiting directly therefrom. All such tax revenues should be dedicated to fish and wildlife purposes.

(3) The Federal Government, with an important national interest as well as direct legislative responsibilities, should contribute to the support of wildlife management. An important contribution should be through financing and initiation of research. Toward these ends we should study the operation in the United States of the Pittman-Robertson Act, Dingell-Johnson Act and Duck Stamp Act, to see if similar mechanisms for financial support of wildlife management might be possible in Canada.

Manpower

In considering staff, we are concerned not only with numbers, which has been mentioned, but also quality. No organization can be better than the personnel who staff it. Like most other fields today, wildlife management is becoming sophisticated. It demands of its practitioners in both professional and technical grades a higher level of competence than ever before.

At the professional level, the primary problem is one of numbers. There is still a critical shortage of wildlife scientists, persons competent in their field of research and willing to undertake field studies of highly complex biotic communities. While it is the task of universities to train scientists, the wildlife agencies should promote and support their training. *It is recommended as a matter of policy that wildlife agencies associate their research activities with appropriate university departments and research councils to provide the environment that will attract the best men and women available to this field.*

At the technical level, the quality of staff is a prime concern. The game warden or conservation officer functions in the age of science but still faces the problems of wilderness, long hours of work, and arduous conditions of terrain and weather. He is the *shock-trooper* who on the one hand gives support to the professional in the accomplishment of management programs and on the other meets the ever increasing army of hunters, fishermen, and general recreationists. As such he must be familiar with the techniques of wildlife management and competent to explain them. Such men are hard to find and hard to hold – yet that must be done.

As a matter of policy, increasingly higher qualifications must be demanded of game wardens and conservation officers. Within the next ten years we should reach the point where completion of a diploma course in wildlife management, at a technical college or university, will be a requirement for personnel being recruited. The concept of game officers as competent, well-educated, and devoted public servants requires some change in the thinking of many of the public, and a radical change in the pay structure for game officers in many provinces.

Executives in wildlife management must provide for proper integration of research, management, enforcement, and public relations. Appointment to the executive level should be dependent upon an understanding of the concepts and philosophies of wildlife management as a part of the renewable resource complex, the purpose and capability of research and its relationship to the *practical* problems of management and enforce-

ment, and the vital need for public information and support.

Priorities and Time Scale

More and better personnel, to permit more and better research and management, seems to be the immediate need. Clearly, however, that aim cannot be achieved without larger budgets, so the first priority must be a critical appraisal of financial support in this field. As a part of that appraisal there should be undertaken a detailed and objective study of the economics of wildlife and recreation. Concurrently, there should be undertaken a much improved information program to make the public aware of the true nature and value of the resource so they may intelligently support it.

On the time available to us. It is hazardous to generalize. Some species of our flora and fauna either have disappeared entirely or are no longer significant elements of our cultural heritage; we are a poorer nation for those losses. At the same time, some species are more abundant than they ever were before advent of the European to our continent, but we have a lot more people now too.

Some intolerant species can survive only so long as there is wilderness, or other specific habitat. Those can be maintained only by the establishment of wilderness areas, parks, and nature preserves. In many areas of Canada the hope of establishing such areas is almost past, at least near centres of population. Any action to be taken must be taken now. Indeed, remoteness and wilderness are only relative terms, and the rapid expansion of Canadians into their frontiers makes complacency respecting any part of Canada a dangerous luxury.

For other species of wildlife the future lies in joint use of productive lands, particularly with agriculture and forestry, and in resolution of the conflicts between users. Deer, ducks, and pheasants typify species that have done well on lands attractive to man. But crop depredations, drainage, *clean* farming, spraying, and other techniques of intensive land use have, in many areas, placed such species in jeopardy.

Thus any statement on timing must finally be subjective. Viewing developments in the wildlife field in the last 15 years, and the economic forecasts for the future, I believe that we shall find ourselves in a completely untenable position unless major decisions on policy are made within the next five years and programs of implementation commenced within ten years. Continued increase of utilization at the present rate without more than concomitant growth of wildlife management programs (they are already inadequate) can only lead to destructive exploitation from which recovery will be painfully slow and costly.

Responsibility

Wildlife is a public resource and thus a government responsibility. It is no criticism of government agencies to say that they cannot move far in advance of public thinking, that they cannot properly place before the public thoughts essential to the formulation of progressive policies and government action, that they cannot speak for themselves respecting hostile pressures nor solicit support from favorable quarters.

Thus there is an urgent need in Canada for a citizens' organization dedicated to the development and furtherance of concepts and philosophies in the wildlife field. There must be an entity that can critically evaluate existing concepts and practices and report its findings to the public; that can examine and report on major industrial and other developments inimical or beneficial to wildlife; and that can act as a catalyst to bring together people, money, and specific agencies in a concerted approach to the solution of problems. I would place the highest possible priority upon the establishment of such a non-government entity in Canada. If our future in wildlife conservation is to prove a social gain, stimulated by wants created by those who satisfy them, and guided by social and governmental processes, we cannot too soon take those steps that will provide the public with facts and ideas upon which they may base adequate value judgments.

References

[1] Hooper, F. Management Survey, Penguin, Books Ltd. 1960. p. 218.

[2] Clarke, C.H.D. *Wildlife in Perspective.* Paper prepared for the 1961 Resources for Tomorrow Conference.

[3] Soil Conservation Society of America. "Objectives and Goals for 1960," in *Journal of Soil and Water Conservation,* Vol. 15, No. 1. 1960. p. 42.

[4] Johnson, H.G. "The Political Economy of Opulence," *Canadian Journal of Economics and Political Science.* Vol. XXVI, No. 4. 1960. pp 552-564

[5] Munro, D.A. *Legislative and Administrative Limitations on Wildlife Management.* Paper prepared for the 1961 Resources for Tomorrow Conference.

SCIENTIFIC NAMES OF SPECIES

SCIENTIFIC NAMES OF SPECIES
MENTIONED IN PAPER ON WILDLIFE

BIRDS

Black duck	*Anas rubripes*
Bluebill (see scaup ducks)	
Bobwhite	*Colinus virginianus*
Bufflehead	*Bucephala albeola*
Canvasback	*Aythya valisneria*
Chickadee, boreal (Hudsonian)	*Parus hudsonicus*
Crane, whooping	*Grus americana*
Goldeneye, Barrow's	*Bucephala islandica*
Goose, Canada	*Branta canadensis*
Goose, blue	*Chen caerulescens*
Goose, snow (greater snow)	*Chen hyperborea*
Grouse, blue (sooty)	*Dendragapus obscurus*
Grouse, spruce	*Canachites canadensis*
Gull, herring	*Larus argentatus*
Gull, great black-backed	*Larus marinus*
Mallard	*Anas platyrhynchos*
Murre	*Uria aalge* and *U. lomvia*
Partridge, Hungarian	*Perdix perdix*
Pheasant, ring-necked	*Phasianus colchicus*
Pigeon, passenger	*Ectopistes migratorius*
Pintail	*Anas acuta*
Ptarmigan, willow and rock	*Lagopus lagopus* and *L. mutus*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Robin	*Turdus migratorius*
Scaup duck, lesser (bluebill)	*Aythya affinis*
Scaup duck, greater (bluebill)	*Aythya marila*
Snipe	*Capella galinago*
Starling	*Sturnus vulgaris*
Swan, trumpeter	*Olor buccinator*
Teal, blue-winged	*Anas discors*
Widgeon (baldpate)	*Mareca americana*
Woodpecker, downy	*Dendrocopus pubescens*
Woodpecker, hairy	*Dendrocopus villosus*

FISH

Carp	*Cyprinus carpio*
Char, arctic	*Salvelinus alpinus*
Chub	*Leucichthys* sp.
Lamprey, sea	*Petromyzon marinus*
Ouananiche	*Salmo salar ouananiche*
Perch, yellow	*Perca flavescens*
Trout, brown	*Salmo trutta*
Trout, rainbow	*Salmo gairdneri*
Trout, speckled	*Salvelinus fontinalis*
Salmon, Atlantic	*Salmo salar*
Sucker	*Catastomus* sp.
Tomcod, Atlantic	*Microgadus tomcod*

MAMMALS

Antelope (pronghorn)	*Antilocapra americana*
Bear, barren ground grizzly	*Ursus arctos*
Bear, black	*Ursus americanus*
Bear, polar	*Thalarctos maratimus*
Beaver	*Castor canadensis*
Beluga (white whale)	*Delphinapterus leucas*
Bighorn (sheep)	*Ovis canadensis*
Bobcat (wildcat)	*Lynx rufus*
Buffalo (bison)	*Bison bison*
Caribou, barren ground	*Rangifer tarandus arcticus*
Caribou, Peary	*Rangifer tarandus pearyi*
Caribou, woodland	*Rangifer tarandus caribou*
Cougar (puma, panther)	*Felis concolor*
Coyote (brush wolf)	*Canis latrans*
Deer, black-tailed	*Odocoileus (Dama) hemionus columbianus*
Deer, mule	*Odocoileus (Dama) hemionus hemionus*
Deer, white-tailed	*Odocoileus (Dama) virginiana*
Elk (wapiti)	*Cervus canadensis*
Ermine	*Mustela erminea*
Fisher	*Martes pennanti*
Fox, arctic (white)	*Alopex lagopus*
Fox, coloured (red, silver, cross)	*Vulpes fulva*
Goat, mountain	*Oreamnos americanus*
Hare, varying (snowshoe rabbit)	*Lepus americanus*
Lynx	*Lynx canadensis*
Marten	*Martes americanas*
Mink	*Mustela vison*
Moose	*Alces alces*
Muskrat	*Ondatra zibethicus*
Narwhal	*Monodon monoceros*
Nutria	*Myocastor coypus*
Otter	*Lutra canadensis*
Pronghorn (antelope)	*Antilocapra americana*
Puma (cougar, panther)	*Felis concolor*
Rabbit, snowshoe (varying hare)	*Lepus americanus*
Raccoon	*Procyon lotor*
Rats	*Rattus* spp.
Seal, bearded	*Erignathus barbatus*
Seal, harbor	*Phoca vitulina*
Seal, harp	*Phoca groenlandica*
Seal, northern fur	*Callorhinus ursinus*
Squirrels, ground	*Citellus* spp.
Squirrel, red	*Tamiasciurus hudsonicus*
Walrus, Atlantic	*Odobenus rosmarus*
Wapiti (elk)	*Cervus canadensis*
Whale, pilot	*Globicephala melaena* and *G. scammonii*
Whales, toothed	Suborder *Odontoceti*
Wildcat (bobcat)	*Lynx rufus*
Wolf, gray (timber)	*Canis lupus*
Wolverine	*Gulo luscus*

Section Eight: Recreation

The Social and Cultural Aspects of Recreation

J. Farina,
Assistant Professor, School of
Social Work, University of Toronto.

The universal nature of leisure in our society presents an opportunity and a challenge that have not been met adequately. The realization of the full potential of leisure depends initially on the inner spiritual, intellectual, social and physical resources of the individual but part of the responsibility rests with government, and this responsibility cannot be met through a patchwork of ad hoc measures devised after needs have become acute. Canada is unique among western nations in its failure to give positive guidance and support to a national policy of recreation.

While traditional military, religious, scientific and social attitudes still influence the use of leisure, new forces are exerting a profound influence and creating their own peculiar set of problems: – mass media communication, mobility, educational systems and organized recreation programs. The concept of recreation as an end in itself, as part of the total living process, is only now beginning to develop.

Much of leisure is used for self-improvement programs, community service and self-indulgence. Much of the pattern seems to be characterized by flight from inner self-impoverishment, unattractive urban surroundings, home environment and reality. True recreation in which man is recreated by voluntarily rising above the everyday considerations of the world of work without external compulsion is limited.

Certain pre-conditions are necessary for the establishment of effective recreation policies and programs. Implied as well as expressed interests must be recognized and provided for. A co-ordinated approach is required among the various levels of government and the different agencies within specific governments that are concerned with recreation. There is a need for a clear definition of goals which gives recognition to the multiple dimensions of recreation. Recreation must be given greater priority in the planning and development of our natural resources so as to provide a physical base for activities. It is necessary to acquire a sufficient pool of competent personnel for recreation planning and program operation.

Leisure, like peace, is something most people say they favor in modern society. Yet it is a word quite as subject to distortion as the word peace.

Indeed some people view leisure as a spectre or a menace to society. Only a few years ago a Toronto newspaper published an editorial entitled "The Spectre of Leisure".[1] In general, the theme was that exacting work for four days a week and then no work at all would "place a great psychological strain on the people involved in that system". The editorial suggested that the alternative is organized leisure and commented that "this has an unpleasant sound".

1. *Leisure as a Challenge and an Opportunity*

The challenge lies in what we make of the opportunities afforded by the continuing growth of leisure.[2] For leisure is, by definition,[3] time which presents opportunity. It can be opportunity for the development of individual and national culture. Josef Pieper in his essay, *Leisure, the Basis of Culture*, propounds the thesis that leisure is the fundamental basis on which culture depends.[4]

Because of unprecedented opportunities leisure is of greater significance in to-day's society than it has ever been in the history of man. In the contemporary world, the first age of universal leisure has arrived for many countries, where leisure is no longer the exclusive prerogative of the wealthiest class.[5] In countries such as Canada it is no longer a question of the pursuit of leisure by the few; it is rather a national problem: how to provide for the varied uses to which all the people wish to put their leisure.

Only part of this responsibility falls on government directly, but that part of it which does poses a formidable challenge in terms of making available (by acquisition or regulation) the necessary physical and financial resources. The major responsibility goes even beyond this; it devolves on the whole of the society. It cannot be left entirely to random individual wishes and capabilities; it can no longer be left to patchwork government measures to meet pressures on an ad hoc basis *after* the need becomes acute.

The essential *leisure problem* is simply that we have failed miserably to grasp the opportunity that leisure presents. It is a sad commentary on our response to the challenge of leisure that recreation is frequently referred to as a problem, that we continue to put the educational emphasis on the techniques for making a living but fail to educate people to live. Why should we be surprised – though understandably dismayed – to find that all too many literally seek an escape from leisure through narcotic relief in the unreal world of the constant vicarious player? We tolerate a situation where recreational opportunities are allowed to lie fallow even while they are desperately needed for a better balanced pattern of social activity, and then cry havoc about the state of affairs.

When we compare the contribution of the small, educated leisure class of Renaissance Europe with the contribution of the ninety per cent literate and leisured people of western civilization over the past 25 years, one cannot help but wonder whether we have recognized the opportunity of leisure, much less used it. In our development of work and destructive potential we outshine every civilized era in history. We are the great creators of leisure. We must now face the task of creating a capacity to use that leisure.

2. *Social Economic Forces Shaping Canadian Attitudes Towards Leisure*

(a) *Basic Influence of Traditional Attitudes*

All-pervasive in Canadian society, and indeed to an extent throughout western civilization, is the influence of traditional attitudes towards recreation. These have been identified as i) the military attitude, ii) the religious attitude, ii) the scientific attitude, iv) the artistic attitude, and v) the social attitude. They may be described as follows:

(i) The *military* attitude reflects the idea that recreation is an important aspect of and should be used in the interest of military preparedness. From aboriginal tribes to the time of the ancient civilizations, to Nazi Germany and the era of the National Fitness Act in Canada, this line of thinking has had strong, vocal and strategically placed advocates;

(ii) The *religious* attitude is that reflected by the Protestant Ethic. This concept may be briefly stated as "only work is honorable and is a defence against all temptations of the flesh". In other words, "the devil finds work for idle hands". The religious attitude has had a pervasive influence on western attitudes to leisure;

(iii) The *scientific* attitude is best exemplified in the German and Scandinavian schools of gymnastic and many schools of physical education. Stylized exercise, scientifically planned for physical development is the result;

(iv) The *artistic* attitude emphasizes art as the ultimate creative and therefore re-creative activity;

(v) The *social* attitude views recreation as a medium wherein individual and group social problems can be prevented, modified or cured.

Recreation as an end in itself, as a part of the living process, as a manifestation of the abundant life and as an opportunity for the enrichment of living and for *fun*, is a currently developing attitude.

(b) *Current Forces in Operation*

In addition to traditional attitudes, recreation today is affected by several important forces peculiar to our time.

(i) The first of these is *the great increase in mechanization and automation* in business, industry and the home. This process has been accompanied by a continual refinement and specialization of tasks. In such a work world opportunities for the satisfaction of basic psychological needs are extremely limited on the job. Few work for themselves, and most are involved in repetitive, monotonous tasks. Moreover the time saved through automation presents a real problem which has not been faced. Is it to be viewed as time to be filled, or as Ott Romney puts it, "time to seek an anaesthetic to fill the pain of empty hours"?[6]

(ii) The second force bearing on the recreation problem is *the tremendous mobility* of Canada's population accompanied by congestion in urban centres. There are several aspects to the mobility of Canadians:

(a) There is a significant shift from a rural to an urban society. In 1956, 67 per cent of Canada's population was classified as urban (in towns and cities with over 1000 population) and over 11 per cent of population lived in cities of over 500,000 inhabitants. In 1931, about 54 per cent of the population was urban and 46 per cent rural.

(b) There is considerable mobility within and between urban settings. In the Canadian real estate business there is a saying that at any given time 25 per cent of the home-owners in any city are either involved in, planning, or contemplating the possibility of a move. One result of this tremendously mobile population is the high proportion of Canadians without significant roots in the community in which they live.
(c) Canada is in the mainstream of international mobility. Since 1946 Canada has received nearly 2,000,000 immigrants and about 650,000 Canadians have emigrated. As congregated cultural groups immigrants have had an effect on our attitudes to leisure. Many come from lands where parks and cultural resources have long been considered essentials of civilized life. Urban and metropolitan recreation facilities are used extensively by these new Canadians and have resulted in modifications in the facilities provided by park authorities. A clear example is the demand for soccer fields, largely from immigrant recreation groups, and the resulting increased expenditure on this type of facility.
(d) Finally, the motor car, public transportation facilities and airlines have made travel throughout the country and indeed throughout the world available to millions of Canadians. Much of this travel is in itself recreation or involves the pursuit of recreation.

(iii) *The system of education* in Canada has a significant effect on patterns of recreation. It seems that all too frequently our Canadian school curricula are designed to prepare the student to make a living rather than to live. Vocational training is an integral part of school systems, even to the university level. Science and mathematics are at present extolled and emphasized as an entree to a high income bracket and a service to defence policy. Scholarship funds come largely from business and industry and are devoted to subjects most likely to benefit the donors. Many subjects likely to benefit the student for the greatest proportion of his time (his leisure), such as music, art, physical education and drama, are de-emphasized, considered educational frills, or completely ignored. Will it be possible to save men from becoming officials and *workers* to the exclusion of all else?

(iv) *Mass communications media* represent another important influence brought to bear on the individual and his choice of recreation activities. The Canadian citizen of today is exhorted through radio, television, newspapers, magazines, public address systems, booklets, pamphlets, brochures, direct mail and every other means of communication to act, buy, go, do, see, etc. Much of the appeal is for luxury or leisure items or services; car, boat, hotel, motel, liquor, soft drinks, vacation resorts, concert, sports event, theatre, cinema, etc. Much of the appeal is directed toward status seeking. The philosophy behind such appeals is based on an economy of consumption. The enrichment of life for the individual is seen only in materialistic terms. Thus happiness is interpreted in terms of material resources rather than in terms of mental, spiritual and physical resources of the individual.

(v) A much more subtle external influence bearing on the individual and his choice of recreation is *the established recreation program patterns of social agencies* in Canada. With few exceptions, these agencies concerned with leisure programs are not indigenous to Canada. Their operations are built on philosophies of leisure and program patterns evolved in the United States, or Great Britain. Operations have been modified to suit Canadian conditions but the fact remains that these agencies did not originally develop to meet the peculiar needs of Canadians. The Boy Scouts Association, the Y.M.C.A. and the Y.W.C.A. had their origin in England, whereas the Boys' Clubs, the Y.M.H.A. and the Y.W.H.A. and most municipal recreation departments are patterned on United States practices.[7]

It is not suggested that outside influence is not a good thing. Rather, it seems necessary to point out that certain outside influences have become so institutionalized in our society that they tend to stifle natural inclination and present a stereotyped pattern of recreation. Borrowing from other cultures gives Canada great potential for cultural growth. If, however, the borrowings are from limited sources and are greater than our internal cultural assets, then surely cultural bankruptcy is the inevitable result.

3. *Variations of Response to the Challenge of Leisure*
In the face of the sociological forces active in today's society, current patterns of leisure use in Canada are extensive, varied, rigidly prescribed and of questionable recreative value. Activities are pursued with all the intensity, efficiency, and lack of inner calm that characterize the world of work. If we view recreation as a field of activity then certainly the Canadian pattern of recreation is rich and diversified. When recreation is viewed, however, as an approach to activities, an attitude toward life and leisure, a creative response to temporal opportunity, then judgment of the Canadian pattern must be reserved.

If we define leisure as simply that time remaining during a week after we subtract work hours, travel time, sleep, and time for personal toilet, then indeed we have an abundance of leisure. However, in contemporary Canadian society it appears that frequently the broader meaning of leisure (as defined above) goes unrecognized. Indeed, in view of the myriad subtle compulsions to which we are subject there may be some question as to the existence of *true* leisure for most Canadians.

The modes in which Canadians occupy this *balance of time* can be classified in a variety of ways. The following classification is not intended to be rigid, for the individuality of people makes possible a variety of responses to any given leisure activity. It does, however, make abundantly clear that *recreation activities are not the sole use of leisure nor are they necessarily the most frequent form of use.*

(i) *Self-improvement* concerns the use of leisure to improve oneself; physically, socially, intellectually or economically. It would include such leisure uses as physical fitness activities, night school courses, tuition in music, art and dancing, vocational training, correspondence courses and *moonlighting.*[8]

(ii) There are three general types of *Community Service:* club membership, volunteer service groups and membership in civic, church, and other groups. The first of these has resulted in a proliferation of clubs, orders and lodges throughout Canada. Volunteer service supports many of the projects of the clubs and societies and supplements public services. We find representatives of every level of society concerned as members of school boards, municipal committees, boards of community agencies, union and professional groups, church committees, etc.

(iii) The third category of leisure use is *Self-indulgence*[9]. Theatre, cinema, spectator sports, television, radio, musical productions, night clubs and reading all might be included in this category.

(iv) There is another category of leisure use which can appropriately be termed *Recreation.* It may be defined as voluntary activity indulged in without external compulsion, which results in the revitalization (or recreation) of body or mind.[10] Despite the very personal nature of recreation and the subjective determinants, society tends to designate certain types of activity as recreation. Music, drama, art, games, sports, athletics, crafts, hobbies, travel, outdoor living, social activities, carnivals, fetes, gambling, drinking, reading, radio listening, television watching, driving, free play, and conversation are examples of activities identified as recreation activities in contemporary Canadian society. On the other hand, all of these activities can literally be *worked at.* We can only determine that which is recreation by the response of the participant. Recreation as a term applied to play or cultural activities is of relatively recent usage. Current usage connotes a positive use of leisure. When such a positive meaning is applied to a given adult activity the term *recreation* is usually preferred to the term *play.* Yet an attempt to trace the development of recreation is faced with the fact that the concept of recreation as differing from play or cultural activity is of very recent origin. Ancient civilizations and pre-literate societies indulged in random play, music, dancing, celebrations, physical contests, dramatics, story-telling, indeed in most forms of activities that we now would term recreation. Yet, anthropologists and historians usually refer to these activities as *play,* as *religious ceremonies* or as *education.*[11] This simply re-emphasizes the subjective nature of the term *recreation.* In Canada today, we have very nearly managed an astonishing perversion of recreation in regarding recreation as a branch of, a tool of, or a frill to education! The result is seen in vast programs presented as organized recreation, involving prescribed activities carefully scheduled and presented in the form of a recreation curriculum. Industrial concerns may also offer *recreation programs* as a means of conditioning workers' attitudes to the corporation. Indeed, since the true value and meaning of recreation lies in its essentially non-utilitarian use, to be recreated, man must rise above the everyday considerations of the world of work.

4. *Canadian Patterns of Leisure Time Activity*

Canadian patterns of the use of leisure for recreation appear to be characterized by *flight.* By characterizing patterns of leisure in Canada by flight it is not intended to make a value judgment. Rather, the intent is to illustrate how our patterns of leisure use reflect the hurry, bustle and tension, the philosophy of consumption and emotional stimulation of our world of work. Our leisure habit patterns do not reflect the inner calm that makes true leisure possible. Leisure for most does not provide the release from materialistic drives nor the freedom from social, economic and psychological pressures which makes true self-expression possible. As Pieper has noted, "The provision of an external

opportunity for leisure is not enough; it can only be fruitful if the man himself is capable of leisure and can, as we say, *occupy his leisure*".[12]

We can distinguish four categories of flight:

(i) *Flight from an inner impoverishment* of intellectual, spiritual and physical resources of the individual. The technological developments, mass production and mass communication media available have served to expedite the Canadian's free time. To a great extent the flight is to the noncreative uses of leisure; self-improvement, community service, and self-indulgence.

(ii) *Flight from the city* is a most important twentieth century development. In the summer months city dwellers literally flood the highways en route to the summer cottage, the summer camp, the resort hotel, the tent grounds, the beaches, the lakes, the mountains, or seashore. In the fall and winter months, a less pronounced but yet significant exodus takes place to the hunting lodge, and the ski resort. On a year-round basis we find continual travel from one city to another to conferences, conventions, spectator events, etc. Industries have developed and public services have been provided to cater to these movement patterns.

(iii) *Flight from the home* in the form of attendance at spectator sports, theatre, club, etc., has not been matched since the days of the Roman Empire. In Canada there is a strong audience response to music, drama, cinema, and art presentation. Night clubs, bars and even the dismal beer parlors of Canada flourish. Restaurants, both domestic and exotic, proliferate in many of the major cities as ever more Canadians regularly dine out. In every city and town, under commercial, club or public auspices, people go out of the home for *the course*. *The course* may be anything from ceramics to yoga, from carpentry to positive thinking, or from how to watch a football game to how to adjust in the first year of marriage. The club movement has mushroomed – today there is a club for everyone. There are athletic, social, service, professional, ethnic, lodge, women's, and business clubs ad infinitum. In general, clubs serve a specific member of the family although recently family memberships in social and athletic clubs have been greatly extended. Perhaps Huizinga's word of warning is appropriate:

> "The club is a very ancient institution, but it is a disaster when whole nations turn into clubs, for these, besides promoting the previous qualities of friendship and loyalty, are also hotbeds of sectarianism, intolerance, suspicion, superciliousness and quick to defend any illusion that flatters self-love or group consciousness".[13]

Moonlighting as an outside-the-home leisure activity is a phenomenon of our times directly related to the availability of significant blocks of free time. Perhaps the *moonlighter*, be he laborer, professional man or business man, is so adjusted to the concept of total work that he is unable to employ his free time except in work. In any event, "moonlighting" frequently takes the individual out of the home during his leisure.

(iv) *Flight from reality* through retreat from social involvement is a prevalent characteristic of our culture. This retreat from participation takes the form of solitary pursuits such as watching television and listening to the radio, etc.[14]

5. *Individual Pre-Conditions for Recreational Activities*

For the realization of the full potential from our leisure we have three resources. The primary resource is the Canadian people and their inner resources; the secondary resource is trained professional people and their skill and dedication; and the tertiary resource is our physical resources. The fundamental problem of recreation resources development in Canada seems to be that of getting the horse in front of the cart. The people in their social behavior patterns and in their expressed and implied values (not readily measurable but fundamental nevertheless) must govern the pace and pattern of change.

How can man himself be prepared to occupy his leisure, to develop his *inner resources*? This is an imperative need for a society of civilized people. Our general thesis is that recreation depends on the inner resources of the individual and the richer these resources the richer his potential for recreation. These inner resources may be categorized as i) spiritual, ii) intellectual, iii) social as well as iv) physical:

(i) *Spiritual resources*

The significance of man's *soul* to leisure, or the religious or spiritual aspect of recreation, has been largely ignored or literally denied in modern civilization. Yet only as man is at one with himself, with his universe, and with his God can he realize that inner calm, that receptiveness of spirit that makes true leisure possible.

(ii) *Intellectual resources*

The intellectual aspect of leisure is not generally appreciated in the mass culture society of today. Conversation, philosophizing, word play and the study of both physical and social sciences can

all be leisure pursuits. Surely the exercise of our intellectual capacities in leisure as well as work will reap rich rewards for our culture.

(iii) *Social resources*

While much that is recreative is solitary activity, most leisure activities involve personal interaction. Certainly the ability to relate easily and effectively in group situations is a determinant of recreation choice and satisfaction. The social skill of affecting good interpersonal relationships is essential to securing satisfaction from a wide range of recreation activities.

(iv) *Physical resources*

Choice of and success in recreation activities is also limited by the physical resources of the individual. The person with a low level of motor skill or auditory sensitivity is not likely to find satisfaction in playing the piano. A person with limited physical co-ordination is not likely to achieve satisfaction in baseball, and a person of limited depth and color perception is not likely to become an artist.

6. *Pre-Conditions for Recreation Policy and Programming*

Canada is unique among western nations in its failure to give positive guidance and support to a policy of national recreation. It is not a uniqueness likely to contribute to the realization of positive goals for leisure use.

(a) *The Need for Understanding Implied as Well as Expressed Interest in Recreation as a Basis for Policy and Programming*

Surely a program of resource development should be based on the pursuit of recreation, rather than the flight from leisure. Such a program should be related directly to the goals and aspirations of the individual and to the goals and aspirations of Canada.

Such a program would be designed with due regard for the factors in Canadian society impinging on the individual and his choice of recreation, with appreciation of the present patterns of leisure use; with an understanding of the meaning of recreation and the individual's capacity for recreation.

Largely overlooked in the planning of recreation resources are what might be termed the implied interests of the people. By this is meant those personal recreation goals which are seldom verbalized in the abstract but can often be implied from expressions of specific interest in an activity.[15] There is, therefore, a need for developing recreational programs with attention to implied as well as expressed interests. Indeed, implied interests could be equated with the social and psychological needs of people which can be fulfilled through recreation.

For the individual we have established our recreation resources in Canada on the basis of assumed interests and expressed interests. We assume that Canadians are interested in sports so we provide sports fields and gymnasiums; we assume an interest in water activities so we reserve lakes, streams, and seaside areas; we assume an interest in social activities so we build social halls. These assumptions are based on the history and traditions of Canadians and the experience gained in the past operation of recreation resources.

In addition to planning on the basis of assumed interests we have concerned ourselves with the expressed interests of the people using the resources provided. Questionnaires, interviews, evaluation statements, suggestion boxes, personal interviews and observations are regularly employed to secure expressed interests. In general such expressions of interest are limited by and related to the potential use of the given recreation resource. Further, such suggestions are usually limited in that they are secured only from those who are actually using the existing resource. [16]

(b) *The Need for a Co-Ordinated Approach*

On a national basis, the provision of recreation resources appears to bear little relationship to national aspirations. No less than 17 branches of the federal government were reported concerned with recreation a few years ago. There appears to be no co-ordinated policy governing national development of recreation resources or programs, nor is there any channel for interprovincial sharing of ideas and discussions of policy.

(c) *The Need for a Clearer Definition of Goals*

A national policy for and co-ordinated approach to the recreation problem might well be based on all or several of the following goals:

(i) *To regard recreation in its many dimensions as a basic source of cultural stimulation and development.* Oddly enough Canadian legislation relating to cultural stimulation completely ignores the potential of recreation. *The Canada Council Act* is predicated on support for the culturally initiated. It concerns itself primarily with what might be termed *the cream* of cultural participants and fails to recognize that it is an abundance of milk that creates lots of cream. We do not play good hockey in Canada because of Maurice Richard, but rather we produce a Maurice Richard because

we play a lot of hockey in Canada. Thus, the more extensive the participation in a given activity, the more possibility there is of a high level of achievement. Recognition of this simple principle through a policy of encouraging a broad range of cultural recreation activities would give great stimulation to Canadian culture.

(ii) *To develop recreation programs in a manner which will aid national identification.* Just as the individual in mass society needs a sense of individuality so he needs a sense of national identity, a sense of belonging to a particular kind of people. This suggests that there should be something Canadian about the resources we provide for recreation. It is not suggested that our recreation resources should be developed in isolation from the world but rather that Canadian cultural components should be prime determinants of design, construction and programming.

(iii) *To improve the non-material standard of Canadian life.* This does not mean greater consumption of material products, but rather a greater investment of social capital. It does not mean the establishment of expensive resort hotels hundreds of miles from centres of population, but the acquisition of properties publicly administered and within a few hours' transportation range of our cities and towns. It does not mean the leasing of park land or facilities to entrepreneurs, but rather a policy of property acquisition and development by public authorities designed to provide the recreation resources required for the abundant life for all.

(d) *The Need to Acquire Competent (Trained) Personnel for Recreation Development.*

If our governments are going to concern themselves with recreation resources development related to the needs of people and national cultural aspirations rather than simply developing resources on an economic or customary basis, then consideration must be given to the personnel involved in resources development. In addition to physical scientists and engineers, social scientists and professional recreation personnel should be involved in the planning, development and operation of our recreation resources. Just as a school depends upon its teaching staff for its effective operation, so a recreation facility depends upon its leadership staff for its effective operation. The leadership required should be professionally trained people aware of the goals inherent in government policy and skillful in interpreting both the implied and the expressed interests of people.

(e) *The Need for Acquiring, Reserving and Planning Resources for Recreational Land Use*

This has two important aspects:

(i) *To give recreational land use a greater priority* in relation to alternative uses. There is an urgent need for the establishment of government policy on land use priority which applies to public as well as private land. Canadians have been nurtured for centuries on the vastness of their country, of its almost limitless resources of forest, streams, lake and shore line, of the vast provision of fish and game, of the extensive mountains, plains and parklands. Indeed, we are blessed with a great natural heritage, but we are only slowly asking: What are the obligations of tenure of natural resources? Canadians are generally being forced farther and farther from the cities in order to find a site suitable for a picnic and a swim. Our myriad waterfront properties are being figuratively and literally fenced off at an alarming rate. It has become obvious that even were it economically possible, every Canadian cannot have exclusive title to a waterfront lot. Indeed, it is not likely that more than ten per cent could have private rights to such property within several hundred miles range of our population centres. For the other ninety per cent, it is becoming apparent that *our* heritage really means *their* heritage. Public authorities have in recent years made efforts to reacquire for the Canadian people their heritage.[17]

(ii) *To make society's needs a criterion for land use planning and control.* There is a further problem related to the use of our recreation resources, that is, to what extent must government control the use of property, and concern itself with the effects resulting from the use? Waterfront property has as great a significance for industrial use as for recreation use and indeed one can affect the other. All too frequently in recent years fine recreation property has been restricted in use, often as a direct result of the use of adjacent or nearby industrial property or as a direct result of municipal government operations. Many industries and municipalities, while extolling the value of our land and water resources, methodically pollute those resources by the indiscriminate dumping of industrial waste and raw sewage into our rivers, lakes and harbors. High cost and discriminatory practices, often based on non-Canadian standards of cost and ethnic relationships, result in some of our most delightful recreation resources catering largely to a limited group of Canadians and for-

eigners. This type of operation in some instances flourishes in government controlled parks.

The fundamental question to be answered in terms of the development of recreation resources is *development for whom?* Are our recreation resources viewed primarily as an economic asset? Are they developed primarily in terms of the potential dollar return? Does exclusiveness of use further national goals? Is recreation development a secondary issue, an additional benefit accruing from development based on other considerations? Does development primarily for recreation use have a low priority with our governments? Is such development related specifically to Canadian needs and aspirations? Does the pattern of development frequently represent arrested cultural growth in Canada? Indeed, at the municipal, provincial and dominion levels of government is there any overall policy governing the development and use of our recreation resources?

Notes and References

[1] The Globe and Mail, Toronto, April 10, 1957.

[2] See "Hours of Work" in Chapter 5, *The Gross National Product and The Gross Domestic Product* in the study of *Output, Labour and Capital in the Canadian Economy*, a study prepared for the Royal Commission on Canada's Economic Prospects. On page 202, the authors of this study predict that the average hours of work per week, in business, will be shortened "from 41.3 in 1955 to 34.3 in 1980".

[3] The Oxford International Dictionary defines leisure as "opportunity afforded by unoccupied time".

[4] Pieper, Josef, *Leisure, the Basis of Culture*, Pantheon Books Inc., New York, 1952. Pieper takes issue with the Puritan view in affirming that leisure is directly related to divine worship. He says, "Feast days and holy days are the inner source of leisure. It is because leisure takes its origin from 'celebration' that it is not only effortless but the direct contrary of effort; not just the negative, in the sense of being no effort but the positive counterpart". He also notes that "Aristotle says of leisure, 'A man will live thus, not to the extent that he is a man, but to the extent that a divine principle dwells within him' ".

[5] The earliest division of labor and the resulting social stratification in primitive society gave certain individuals and classes leisure. Gradually there emerged an identifiable leisure class. The availability of and grasping of the opportunity presented by leisure gave great impetus to man's cultural development. Western civilization today is literally built on the achievements of the leisure classes of Babylon, Egypt, Greece, Rome, Medieval Europe and Renaissance Europe. The Protestant Reformation and the Industrial Revolution introduced the concept of work as the ideal activity. "The nineteenth century left little room for play and with that age, culture ceased to be played; work and production were the ideals of the age imparting a deadly earnestness to life". For the twentieth century the same statement probably would hold true with the possible addition of "consumption" to "work and production". (See Turquet, P.M., "Bread and Circuses" in *British Columbia's Welfare*, September 1949, p. 7.)

[6] Romney, Ott, "The Group", in *The Field of Recreation*. American Association of Group Workers Volume 9, No. 1. April 1947, p. 8.

[7] To a large extent, the French-speaking Canadians have been insulated against the influence of agencies of foreign origin. The pattern of recreation organization in Quebec has been based on the parish and rooted in the traditions of four centuries of life in Canada. In the cities and industrial towns of Quebec, however, the traditional patterns have been tested and modified in the past quarter century. New and growing industries have resulted in an influx of "English" technicians and managers. Modern business methods and personnel practices have influenced recreation patterns. There may be some doubt as to whether French Canada can maintain its tightly-knit social structure and cultural patterns in the face of a rapidly developing economy.

[8] *Moonlighting* is included on the assumption that earning extra money to improve one's material standard of living constitutes self-improvement.

[9] This term is not used in a derogatory sense and it is not meant to imply over-indulgence or dissipation. Rather the term refers to those activities pursued for emotional or sensifacient satisfaction. The first two categories noted above are compatible with the world of total work. The third, self-indulgence, may as often be recreative as are most of the activities we classify as recreation, but can also be the antithesis of recreation, that is, debilitation of mind, body and soul.

[10] According to this definition, recreation is a personal thing. The determinants are whether or not activity is voluntary, whether or not the compensation is the satisfaction of participation and whether or not the result is the recreation of body or mind. On this basis any activity, including all those noted to this point, could be recreation. If a man digs a ten-foot hole simply because at that time he enjoys digging, and if he is under no external compulsion to dig, and if the digging results in a revitalization of his body, mind or spirit, then digging a ten-foot hole is recreation for that man on that specific occasion. If, on the other hand, a man is paid a salary to be at the baseball park at a given time, and plays a two-hour game, then that particular game of baseball for that man was not recreation.

[11] Speaking of education in this regard, Josef Pieper notes "...leisure in Greek is 'skole', and in Latin 'scola', the English 'school'. The word used to designate the place where we educate and teach is derived from a word which means leisure. 'School' does not, properly speaking, mean school, but leisure". This suggests that education, properly speaking, should be more closely identified with recreation than with work, or that education should be viewed as a potentially re-creative activity. Pieper, Josef, op. cit., p. 26

[12] Pieper, Josef, Op. cit., p. 71.

[13] Huizinga, Jan, *Homo Ludens*, Routledge and Kegan Paul Ltd., London, 1949, p. 205.

[14] According to the A.C. Neilson Company, "Currently, we Americans are devoting an estimated 160 billion 'man hours' annually to television viewing. That's on a base of 5.03 hours per home per day (July 1959 — May 1960 average) and 1.9 viewers per viewing home". *(The Neilson Newscast*, Volume 9, No. 4, August 1960). There is no reason to suspect that, relatively, these figures would be significantly different in Canada.

[15] Examples of implied interests or needs are: need for a creative outlet, for tension release, for adventure, for social relationships, for opportunities for self-realization, for a sense of belonging, for health and a feeling of physical and social fitness, for a sense of achievement, for the enrichment of life, for fun, and for personal identification.

[16] An exception pertaining to the field of recreational activity for park, campsites and other outdoor recreational resources is provided in the work done by W.M. Baker. See *A Report on Outdoor Recreation in Southern Saskatchewan*, Department of Natural Resources, Saskatchewan, 1958. The questionnaire used and the techniques employed for sampling the *whole* population of Saskatchewan are described in this report. (Part 1, Ch. 1, pp. 1–91)

[17] In 1959 two waterfront lots were acquired on Lake Erie by a group of summer residents who did not have waterfront property as individuals. They planned to build a community centre on this land thus giving access to the waterfront to dozens of families. Private waterfront property owners opposed this action and took the case to court. The community centre group won the court case. This perhaps represents a breakthrough. The rights of a group to waterfront property were given priority over the rights of individuals to exclusive enjoyment of such property.

Bibliography

1. Bendix, Reinhart. *Max Weber, An Intellectual Portrait.* Doubleday & Co. Garden City, N.Y. 1960.
2. Canadian Youth Commission, *Youth and Recreation,* Ryerson Press, Toronto. 1946.
3. Community Programmes Branch, Ontario Department of Education, *Comments on Municipal Recreation.* Toronto. 1957.
4. Department of National Health and Welfare, Research Division, *Activities of the Federal Government Related to Recreation.* Ottawa. 1955.
5. Durkheim, E. *Division of Labor,* The Free Press. Glencoe, Illinois. 1947.
6. Farina, John, "Recreation", *Canadian Welfare,* vol. 31, No. 5. Dec. 1955.
7. Farina, John and Thompson, Lilliam. "The Two Way Lane to Leisure", Proceedings, The Canadian Conference on Social Work. 1950.
8. Fromm, Erich, *Man for Himself,* Rinehart & Co., Inc. New York. 1947.
9. Huizinga, J. *Homo Ludens,* Routledge, Kegan Paul Ltd. London. 1949
10. Institute for Training in Municipal Administration, *Municipal Recreation Administration,* International City Managers' Association. Chicago. 1945.
11. Jacks, L.P. *Education Through Recreation,* Harper and Bros., New York. 1932.
12. Larabee, Eric & Meyersohn, Rolf. Man's Leisure, The Free Press. Glencoe, Illnois. 1947.
13. Lecomte du Nouy. *Human Destiny,* Longmans, Green & Co. Toronto. 1947.
14. Lee, Joseph. *Play in Education,* National Recreation Association. New York. 1942.
15. Mitchell, Elmer D. and Mason, Bernard S. *The Theory of Play,* A.S. Barnes & Co. New York. 1948.
16. Lindeman, Eduard C. Leisure – *A National Issue,* Association Press. New York. 1939.
17. Neumeyer, Martin and Neumeyer, Esther. *Leisure and Recreation,* A.S. Barnes & Co. New York. 1949.
18. Pieper, Josef. *Leisure, The Basis of Culture,* Pantheon Books, Inc. New York. 1952.
19. Riesman, David and Glazer, Nathan. *The Lonely Crowd,* Yale University Press. New Haven. 1950.
20. Romney, Ott. "The Field of Recreation", *The Group,* Vol 9, No. 1. April 1947.
21. Shapire, Jack. "The Effects of Automation on Leisure Time", *Proceedings of the Canadian Conference on Social Work,* 1956.
22. Slavson, S.R. *Recreation and the Total Personality,* Association Press. New York. 1948.
23. "Sociological Aspects of Leisure", *International Social Science Journal* UNESCO, Vol XII, No 4. 1960.
24. Stone, Gregory, "Research Into the Human Element of Wilderness Use", *Proceedings of the Society of American Foresters,* 1956, Washington. 1956.
25. "The Uses of Leisure", Special Issue, *American Journal of Sociology,* Vol. 62, No. 6. Sept. 1957.
26. "The Youth Service in England and Wales", Report of the Committee Appointed by the Minister of Education in November, 1958: Her Majesty's Stationary Office. London. 1960.
27. Turquet, P.M. "Bread and Circuses", *British Columbia's Welfare,* Department of Health and Welfare. Victoria, B.C. Sept. 1949.

Culture and Recreation in Montreal

Claude Robillard,
Director of the Montreal City
Planning Department

Translated from French

Certain cultural items have been introduced in the recreation program of the Montreal Parks Department during the last ten years.

Art and culture have not taken the place of sports and games which are flourishing more than ever. They have been added *to what already existed.*

They appeal to those who do not participate in sports and to those who, after having played sports, want to do something else.

Montreal wishes to offer a varied recreation program to its citizens of all ages. A few examples: singing, drawing, drama, puppets, painting, ceramics, woodburning, bookbinding, pantomime, movies, woodwork, puttering.

The program is modified in accordance with the success of various special items and our ability to recruit experts and instructors, but not teachers.

The technique consists in first interesting the child in a special line of activity such as puppets, a play, or ceramics and then inviting him to take part in a show, to create something himself. Participation in sports has contributed to the production of fine athletes in Montreal. The participation of a large number of people in cultural activities may produce great artists, will certainly enrich the life of the participants, and will create a more pleasant atmosphere in the city.

Half of the people believe that spare time gives an opportunity to do nothing at all. I am more interested in the other half, in those who believe that spare time is a gift that enables us to do something different rather than nothing at all.

The schoolboy, the mailman, the magistrate who have some spare time are fully justified, when they put aside books, mail-bags or judge's gown, to enjoy complete luxurious idleness, but the schoolboy will be a better schoolboy if he spends his spare time playing, the mailman will be a better mailman if he occasionally goes fishing and, of course, the magistrate will be a better magistrate if he plays golf.

Blissful idleness can be the root of all evil. I am not saying that one must always be on the move. No, I am simply saying that spare time is too valuable to be buried six feet underground, as if it were a valueless corpse.

All men are born free, but, fortunately, all men are also born different. Differences in human characteristics even sharpen up as men grow older. It is quite obvious, then, that the use of one's spare time is a matter for personal decisions, depending on tastes and yearnings. You have one hundred persons; you also have one hundred different problems. The solutions to these problems are numerous, and nothing prevents the application of the same solution to several cases.

The main thing is to have more than one string to one's bow, or, if you will, one must not put all his eggs in one basket. Men differ, and their leisure hours may also be spent in a different manner. It is a waste of time to look for a recipe for a single dish to everybody's taste. We need several recipes and several dishes.

It is not for me to enumerate all the types of recreation planning. I should restrict myself to the municipal field and to my experience in a single city, namely Montreal. I should also confine myself to the cultural aspects of our recreation program. Needless to say I am not going to give Montreal as an example of a city where the problem has been solved once and for all. A problem is never definitely settled, everything is subject to change, to reassessment and readjustment. One does not copy but draws inspiration from what is being done next door; imagination provides the rest.

When ten years of age, I lived in the vicinity of La-Fontaine Park and used to go there and play baseball. I could also have played tennis or gone boating in the renowned gondola pond. Today, my children make pup-

pets there, paint, take part in a stage play or dance a tarantella.

"How times have changed!" Children still play baseball and tennis but art and culture have also invaded LaFontaine Park. This, surely, is a most delightful type of invasion in a modern civilized society.

Every winter 19,000 hockey players of all ages register in the Montreal parks, form 1200 teams and play 9,000 games in 60 days. In the summer, over 750 teams perform on 45 baseball diamonds, 115 softball diamonds and 30 football and soccer grounds. The number of teams, of sportsgrounds and lighting installations is increasing from year to year. Sports are not dying - long live sports!

However everyone is not fond of sport and sportsmen are not playing all the time. Consequently, art in the recreation program appeals to those who are not fond of sports and to sportsmen when they are looking for some other form of recreation. If the narrowly-read man is to be feared, one may also be a little displeased with a young boy who thinks only of hockey or a little girl who spends all her time reading *Bobbsey Twins*. In recreational education one has a much better chance of becoming the whole man of the classical period, that is to say, the man who is interested in all manifestations of the human mind, if one does not devote oneself to a single special line.

Children are not all built according to the same pattern. During their leisure hours they do not all want to amuse themselves in the same way. A municipality that wishes to supply recreation facilities to all its citizens, the young or the old, the muscular or the puny, the quick-witted or the slow-witted, those endowed with much or with little imagination, energy, feeling, versatility, ought to vary its recreation program.

This is what we have been doing in Montreal for about ten years. Let us examine the various special items which are included in our recreation program, besides sports and games of all kinds. A child who comes to the Montreal parks, either on a playground during the summer or in a recreation centre at any time of the year, may choose one of the following amusements: singing, drawing, dramatic art, puppet shows, painting, ceramics, woodburning, bookbinding, pantomime, movies, woodwork, puttering, etc. The list may be extended almost indefinitely and the program is to be modified according to the success of various items and our ability to engage the services of different specialists.

Let us state at once, with regard to all those specialties, that our first objective is recreation and not the founding of schools. It is never a matter of replacing the teacher, but only of enabling the *client* to organize his spare time pleasantly. However, one should not feel too sad if the *client* also learns something at the same time.

How did we succeed in introducing these new items in our recreation program? The technique is quite simple: interesting the child in what others may do in one specialty or another, and then giving him the opportunity to take a hand in it. In other words, we let him see what others can achieve and then let him do it himself.

For example, let us consider puppets. We began by giving puppet-shows. The children came to see them for diversion, to amuse themselves. We then invited them to go behind the scenes. There they saw the puppets, and discovered what fun it was to work them. At once they wanted to make some themselves and we gave them the means to do so. The next step was to show them how to manipulate the puppets, then to invent stories themselves, to write their own scripts or to take part in such writing, to learn the secrets of stage-lighting, of the sound system, etc. In the recreation centres of Montreal, children and adolescents have made, during the last few years, over 10,000 puppets and they have performed in countless shows before their friends who themselves soon became inclined to do better than sit down and look at other actors.

It is not to be thought that puppets have been popular only in select districts, somewhat like the Tuileries or the Luxembourg. Children from poor districts are excessively fond of puppets and make some very amusing ones. It should not be thought either that only little girls or only little boys who are somewhat effeminate or frail choose this form of recreation. Once again, all strapping fellows do not always play baseball or hockey; they may very well be interested in something else, and there has been ample proof of this in Montreal.

Painting is another example. Every year we buy a few tons of wrapping paper on which appear, as if by magic, thousands and thousands of *masterpieces*. We supply the paper, the paintbrushes and the water colors. The instructor merely gives advice here and there, makes a suggestion or a criticism, but never takes the paintbrush from the child's hand. Here also, we began by interesting the child in certain exhibitions and we soon had most of them as participants. I have at home a lovely painting showing two wandering Spanish musicians. The painting is the work of two young artists, one a nine-year old boy and the other an eight-year old girl; one painted the left half and the other the right half of the picture. It is unskilful and unaffected but quite admirable! The central figures are well arranged, the colors are fresh and blend remarkably well. The joy which prevails in the work assuredly reflects the joy felt by the painters themselves.

Each year, we have several exhibitions of children's paintings and many other exhibitions. At the Hélène-de-Champlain Gallery in the restaurant on St. Hélène's Island, we have a new exhibition every month, often showing works by painters from the Montreal region and those by painters from foreign countries. Every summer, on Dominion Square, we set up *The Square des Arts*, which is an exhibition that artists themselves organize for the sale of their paintings to tourists and Montrealers. I have already mentioned that a recreation program must appeal to everyone. In the case of painting, we have begun with the children and we now have sessions for persons of every age.

What have we accomplished with regard to drama? In the beginning, it was rather difficult to stage a play in the parks for the very reason that prevented a famous general from bringing his guns into play: he had no gun and we had no stage. We have then built our first theater and we have made it mobile so that the greatest possible number of children may take advangage of it. This theater, called *La Roulotte*, has moved about the parks since 1953. It is something like the story of Mohammed going to the mountain, except that the theatre itself visits every ward of the city. It consists of a large box, 31 feet long, the two sides of which open out; one side forms the stage and the other provides a backstage area. On the left side are the sound and lighting controls, and on the right side a dressing-room and a make-up room for the actors.

The show consists of two parts. Some numbers are presented by the children of the park that is visited on that day and some numbers are presented by the troupe which, during the whole summer, accompanies *La Roulotte* to the parks. By taking part in the shows, the children learn how to face the public and to put their talents to the test. They sing, dance, play sketches, form small orchestras, etc. The other part of the show makes them members of the audience and gives them the opportunity to see good theatre and perhaps to improve on what they will present themselves the next time. The plays staged by the troupe of *La Roulotte* have been selected for children but have always attracted a large audience of parents. The 50 shows given every summer attract about 100,000 spectators, and quite often, in certain large parks, 3,000 persons attend the performance.

I may also mention *Le Vagabond*, a traveling theatre for puppets. It is smaller than the other and the monitor can easily hook it to his car.

Coming back to the theatre, it is obvious that "La Roulotte" can be used only during the summer months. We wanted to do something else the rest of the year. Little by little, we have built stages in our recreation centres and have invited amateur troupes to avail themselves of these stages. We have secured the services of a special instructor who assists in the staging, the setting, the choice of play, the casting, the making of costumes, etc. One of the companies, the *Théâtre de Quat'Sous*, won the first award in 1958 at the Dominion Drama Festival in Edmonton.

We have also built, in LaFontaine Park, an open-air theatre where concerts are given - particularly band concerts - but the theatre is also used for drama presentations. Finally, we have contributed to the setting up of the old powder-magazine at St. Hélène Island as a theatre and we co-operate with the *Mountain Playhouse* theatrical troupe in Mount Royal Park.

The seventh art, the cinema, is not far removed from the theatre. We have included it in our program. Educational films have long been held in high regard, particularly at the Botanical Garden where children fill the Garden auditorium three times every Saturday morning, to watch a wide variety of films, many of these describing the wonders of Nature. The cinema has spread to the recreation centers and, there also, the children may look at educational films. We have also organized a film club where the films selected are discussed and commented on by young people who have enrolled as members of the club. In several instances we have encouraged the children to take part in the production of a film. Some have agreed to play a part, others have made the costumes, stage sets or the props and still others have helped the producer with the shooting of the film. The films thus produced have been shown in recreation centres, together with films describing other activities in the Montreal parks. One of the films produced by children, *Princesse Chagrine*, lasts about twenty minutes; 80 children were occupied in its production for six months.

I cannot dwell too long on each of the other special features of the program. The objectives are the same in each case, and any special features included in the program remain only so long as they are successful.

Folk dances, to give another example, have been very popular. We organize them during the whole summer in the parks and during the remainder of the year in recreation centres, including park-schools. I can say that the Montreal police are glad to see the energy of exuberant youngsters spent in this manner rather than in more boisterous ways, from the viewpoint of public peace. We are not satisfied with having people hopping about, but we take this opportunity to teach them the dances which are popular in other countries. Not only do they come to know the folklore of the whole world but, thanks to our folklore studio and to its splendid collection of national and local costumes, to its books and to its record libraries, they gain a better knowledge of their fellowmen of all colors and from all countries.

Each summer we employ in our parks a staff of 450 monitors; in our 20 recreation centres and for the organization of our sports program we employ about 60

the whole year. Some of them are specialists but most of them are jacks-of-all-trade who can play several roles and have more than one arrow in their quiver. I say this because it might be thought that additional personnel must be added when we introduce cultural elements. No, it is enough that the monitor knows how to carry his gun on either shoulder.

For this reason it is difficult to establish the precise cost of our *artistic* activities. Let us, however, look at some figures: the Parks Department has an annual budget of $6 million. Maintenance of the parks and playgrounds, the planting and maintenance of trees and flowers in our streets and parks, the operation of our vast Botanical Garden absorb $4.5 million; the remaining $1.5 million is for the organization of our recreation program, games, sports, golf, tennis, swimming pools and *the arts*. The cultural activities cost about seven per cent of the $1.5 million or about $100,000.

The recruiting of staff is not easy. There is no question of selecting it haphazardly because the success of our program depends on the judicious choice of monitors. We started by organizing our own course for the formation of personnel. Now we have succeeded in getting the universities to offer courses leading to a diploma and we co-operate by furnishing teachers. It goes without saying that we also help the monitor to improve after he has been engaged. The cardinal rule is to try to find the monitor with the *sacred fire* who takes pleasure in spreading happiness around him.

What is the result of all this cultural activity? We may say that we have helped thousands of Montreal people, young and old, to spend their spare time more pleasantly. This was our first goal and we know that we have already achieved it. Montrealers who were quite free to reject this part of the recreation program, have taken part in it eagerly. The amusement aspect of the program is easily justified, but, as I have indicated, we hope for something more. People who are only looking for amusement cannot be entertained indefinitely; they soon reach a stage of boredom as some kings did, in spite of their buffoons' tricks. That is why we have insisted so strongly on the active participation of our *clients*, firmly believing that they would not regret having gone beyond the role of spectator to reach the greater satisfaction that comes from involvement.

It is easy to cite examples that are edifying, but they do not always permit generalization. Nevertheless, there is the example of a 14-year old boy whose excessive stoutness did not allow him to indulge in sports. We had 1,200 hockey teams and 400 softball teams but nothing for him. Then what — lounging about, smoking, drinking? Such was the track that he followed till the day he was asked to play the part of the fat cook in the film *Princesse Chagrine*, and then several other parts in the super-productions of the parks department. This boy evidently found more than a way of killing time. He won back his self-confidence, enjoying the luxury of personal success, had the pleasure of being one of a team and of being accepted instead of being an object of mockery.

In one of our recreation centres, the painting instructor asked the children to make a sketch of their mother hanging out her washing on the clothes-line. Twenty minutes later, a somewhat shy little girl decided to tell the instructor about an idea she had and said: "Are we allowed to draw two suns?" The instructor explained to her that undoubtedly the great masters have never painted more than one sun in a picture, but he added immediately that a little girl was quite free to draw two suns if she wished. The little girl was delighted and replied: "It is so that my mother's washing will dry more quickly".

What is important and what my first and second examples illustrate is that the child is given an opportunity to express himself in his own chosen way. The playgrounds and the recreation centers greatly differ from the school where attendance is compulsory and the program quite rigid. I trust that in school the teacher would have allowed the little girl to draw two suns, but I cannot be sure.

While playing, the child learns to accept gladly a discipline which constitutes the rule of the play. Play moulds the character and shapes the citizen.

I have said before that examples do not prove much; they may be the exception to the rule. The effect produced on the Montreal people as a whole, through the introduction of cultural elements in the recreation program of the parks, is more difficult to evaluate than the effect it has had on certain individuals. But I believe that this effect cannot fail to be beneficial.

A Florentine has a better chance of becoming a great artist than a Patagonian. Parisians, as a rule, are better cultured than Eskimos. The Florentine sculptor and the Parisian novelist have undoubtedly worked hard to become what they are but, assuredly, the blooming of their personality and of their talent would not have found as good a terrain in the Tierra des Fuego or in the Northwest Territories as in Florence or Paris. It is not an inconsequential fact that from their childhood the Florentines live in the atmosphere of Michelangelo's David, of the Paradise Doors and of the Uffizi Gallery, or that the Parisians move about in the few square miles that have been the scene of so much thinking and discussion during the last two millenia.

The Montreal sports program has produced celebrities such as Maurice Richard, Bernard Geoffrion and many others because thousands of children can play hockey in the parks. The famous Montreal Symphony

Orchestra now has 2,500 subscribers, because we were wise enough, 25 years ago, to initiate the symphonic matinées for children. The Museum of Fine Arts similarly profits by attracting young people. Why should this kind of opportunity be restricted to small groups or special clubs? Why not bring it within the reach of all Montreal children in their public parks? Why not create an atmosphere in Montreal that is favorable to the flowering of all kinds of talents?

The arts included in the Montreal recreation program will bring answers to all these questions. So much the better if, partly on that account, our children, their parents, and soon our grandchildren find that the Montreal air is more pleasant to breathe.

The Forces Shaping Demand for Recreation Space in Canada

Lloyd Brooks,
National Parks Branch,
Ottawa, Ontario

The demand for outdoor recreation space is growing at an unprecedented rate chiefly because of increasing population and leisure-time opportunity.

The population factor alone, with its rapid rate of increase, gives rise to the expectation that we will face great shortages of land of the right type in the right amount and in the right places to meet recreation needs. When the population increase is compounded with the growing influence of the leisure-age factors of rising personal income, more leisure time and greater mobility, we will experience a demand for recreational resources of an astounding magnitude over the years ahead.

Rising income levels mean increased opportunity for the Canadian people to take advantage of the recreation potential of the resource base. The increase in personal income will certainly mean corresponding increase in expenditure on recreation which, when coupled with a growing population, will be yet another powerful factor exerting its influence on demand for recreation space. If, as seems so likely, there is an increase in the proportion of income devoted to recreation then there could be a great acceleration of recreation expenditure and a related powerful impact on our land resources.

There are other aspects of the accelerating demand trend that call for consideration. It is not simply a matter of burgeoning numbers, but also of growing youthfulness and regional concentrations of our populations which indicate an immensely growing demand in the near future for outdoor recreation space of particular types in particular places. The pressures of intense demand will be most acutely felt in the regions surrounding the existing population concentrations and in the main holiday regions. The expanding younger segments of the population will further increase demand for broad expanses of land and for land suited to the more active outdoor pastimes such as swimming, skiing, camping, picnicking and boating. The growing older age groups, particularly evident in certain regions, indicate increased daily demand for urban parks and extension of the use season in the larger holiday parks.

Growing productivity will produce dividends in the form of more personal income and more leisure time which will further complicate the nature of the demand for outdoor recreational opportunity. These will require suitable surrounding and amenities as the demand grows and changes in character. The steady reduction in the hours of work portend a possible three-day weekend and one month annual vacation. Such an eventuality could greatly expand the weekend and vacation travel range of the populace, bringing remote terrains within reach of the recreation seeker and within scope of regional planning.

Technological changes, such as changes in mobility and improvements in recreational equipment also have a strong bearing on recreation demand. The automobile has profoundly changed recreation habits in range, variety and intensity over the last half century and indications are there will be still further changes as greater numbers become mobile and, through more time, more money and better roads, are able to range further afield.

The development of recreational equipment means not only greater availability to greater numbers but also changing demands on outdoor recreation space. This can result in surprising surges of demand for special types of terrain and climatic conditions such as we are presently witnessing from the winter skiing populace.

When compounded the above factors indicate a demand for outdoor recreation space, in the immediate future, which staggers the imagination. In nearly all cases this demand involves availability of special land and water areas in quantity and variety. There is a foreseeable limit to such land. There is no foreseeable limit to the presently burgeoning demand.

Two dominant socio-economic forces are influencing the upswing in demand on our recreation resources today: the growing numbers of people and the growing ability of those people to participate in leisure time activities. The first is a much analysed and reasonably predictable factor; the second is actually a mixture of contributing factors which are peculiar to this leisure age, most of which have undergone little or no systematic research study. These *leisure-age factors* are to some degree interdependent and are the direct result of the powerful coincident forces of an expanding economy, mass production and automation. Working together these forces are creating the increasingly pleasurable situation for the bulk of the people where leisure time opportunity is enhanced by increased income and a ready mobility.

No other civilization in the history of man has had such a favorable set of circumstances working to the advantage of so many. It is the very uniqueness of the new leisure era and the rapidity with which we are entering it that are finding us quite unprepared to either fully reap its benefits now or to provide adequately for future generations. Study of the primary factors creating this surging demand for open space should give us a basis for meeting the unprecedented challenge which has so great a bearing on the happiness of future generations.

1. *The Population Factor.*

The population pattern, both in terms of numbers, composition, and distribution is a fundamental factor to be considered in the evaluation of the demand for renewable resources for recreation use. Many of the present evaluations of the adequacy of park land systems and the expansions required to meet future needs are based almost entirely on the ratio of present acreages to present populations and their predicted rates of growth, modified somewhat by changing age and sex composition. Even though it is realized that the acreage per person factor has serious limitations as a basis for recreation planning, if land is reserved on the basis of projections of this type an important step will have been taken toward staving off a future *famine* of recreation lands 25 or 50 years hence.

(a) Total Population and Rate of Growth.

The rate of population increase in recent years has been startling. Within the last few years our population has been increasing at an average rate of 2.7 per cent a year. Trends indicate that a rapid rate of growth will continue because of high birth rates and declining mortality.

In 1956 the population of Canada totaled about 16 million. The 1961 census will probably raise this total to well over 18 million. Assuming a fairly consistant level of immigration the projected population for 1975 is about 25 million. (1) This would represent a 55 per cent increase in the 20 years from 1955 to 1975. This is the fastest rate of growth of any industrial nation in the world. By comparison with the rate of increase of 1.6 per cent a year for the United States and 1.5 per cent a year for the whole world, it can be referred to as a *population explosion.*

(b) The Distribution of Population.

In Canada as a whole there is a marked concentration of population in a number of pockets centered on the St. Lawrence lowlands, Winnipeg and South West British Columbia. About 62 per cent of the population of Canada resides in a corridor of land extending 700 miles from Quebec City to Windsor and comprising less than one per cent of our total land area. (2) Over 50 per cent of the population of British Columbia is concentrated in the extreme southwest corner of the province.

This pattern has not changed greatly over the years and it is not likely to alter much in the future, except possibly to become more pronounced proportionately. Although Canada is one of the most sparsely populated countries in the world when considered from the standpoint of total area, our physical geography and climate have resulted in a peculiar pattern of population concentration which will not likely be disrupted in the immediate future.

This population growth is not by any means uniform across the country. In the last 20 years British Columbia population has increased at double the Canadian rate while in Saskatchewan the population has actually declined.(3) These differences are due mainly to regional shifts in population as a result of industrial developments based on resources and market advantages plus the increasing importance of what are called *amenity resources* such as climate and scenery. (4)

In recent years there has been a rapid increase in the urban component of the population. Indeed the concentration of population observed on the national scale is mainly a reflection of this trend in urbanization for it is in these pockets or belts such as the St. Lawrence Lowland that a very high proportion of the cities of Canada are located.

Population of the Metropolitan Areas of Canada 1956

Atlantic	St. John's, Nfld.	77,991	
	Saint John, N.B.	86,015	328,206
	Halifax	164,200	
	Quebec	309,959	
	Montreal	1,620,758	
	Ottawa	345,460	
Central	Toronto	1,358,028	4,302,354
	Hamilton	327,831	
	London	154,453	
	Windsor	185,865	
	Winnipeg	409,121	
	Edmonton	251,004	
Western	Calgary	200,449	1,651,038
	Vancouver	665,017	
	Victoria	125,447	
			6,281,598

From the Table above it will be noted that 15 metropolitan centres contain 37.5 per cent of the total Canadian population. Seven of these, with 67 per cent of population of the metropolitan areas, are located in the St. Lawrence Lowland. About 80 per cent of the total population of Canada live in cities of 25,000 or more.

It has been predicted that these existing urbanized areas will continue to *thicken* under the influence of natural increase, immigration and continued migration from our hinterlands to our cities. One prediction contends that by 1980, 92 out of 100 workers will be engaged in non agricultural pursuits. (5) As stated by one authority, "we can look forward to a world of ever expanding towns set in a sparsely populated countryside."(6)

These gross figures for population and rate of growth along with the refinements for distribution and age composition noted below are a clear indication that there will be a phenomenal leap in the demand for outdoor recreation facilities in the next few decades.

(c) Age Composition.

Canada is rapidly becoming a nation of predominantly young people. Similar to most western nations Canada had a *baby boom* following the termination of the last war. However, different from most other countries Canada's natural population increase continues to gather momentum. This means that the younger segments of the population are growing at a much faster rate than are the other segments. By the mid 1970's the median age will be about 27 years as against the present 30 years.(7)

We are now witnessing a most dramatic change in the nation's population namely the increase in the teen age segment during the period 1955 to 1965. As the decade progresses and we enter the 70's there will be rapid family formation as this group reaches adulthood. Later in the 70's the results of these new families will become evident in the very large proportion of children in our population. By 1970 it is expected that there will be 30 per cent more children under five years of age than at present.(8)

There are regional differences in these changes in age structure of our population which are worth noting. Perhaps the most evident is that in southern British Columbia which has long been a destination for those reaching retirement age. This has resulted in a doubling of the 65 and over population segment between each census and, different from the rest of Canada, there will be a continuing increase in this group as well as in the younger groups in the years ahead.(9)

2. Increased Available Time and Income.

When the population factor is compounded with consideration of increased personal income and increased available leisure time, which are sometimes called the *Leisure-Age Factors*, we have indeed a potentially dynamic force shaping the demands for recreation space in the years ahead. Just how much and in what manner these leisure-age factors will affect demand, no one can say exactly.

There is a vast unexplored area of economics and human behavior here which has undergone very little systematic study. This is understandable since it is only fairly recently that these leisure-age factors have become a major force in the life of everyday citizens. We simply do not have sufficient precedent to guide prediction of future demand trends as the populace becomes more affluent and gains the free time to exercise discretion in choice of activity. However, every factor points to an era ahead in which the character of life in Canada will be greatly changed. We will gradually become a leisure-orientated society in which the big problems will be not only how do we feed and house our populations, but how do we provide the opportunities for a wholesome use of an abundant leisure time for an *exploding* population.

(a) Increased Leisure Time.

In addition to higher incomes, the growing productivity of the nation has produced dividends of free time for all citizens. Some believe that the *gift* of leisure is in fact the biggest story of our time. Certainly it has a strong bearing on our way of life and it is a potent factor influencing the demand for recreation space.

A review of the changing length of the work week since 1870 shows that it has been reduced by about 45 per cent and will likely be cut in half by 1970.

Changing Work Week
1870–1970

Year	Work Week in Hours	Leisure Time in Hours
1870	68	16
1900	60	24
1930	48	36
1940	47	37
1950	45.5	38.5
1955	41	43
1970	35	49

Source: Taylor, G. D. *An Evaluation of Non-Urban Recreation and Tourism.* Unpublished Paper.

Since the hours required for sleeping, eating and personal hygiene remain relatively constant the free or leisure time will have increased three times over in this hundred-year period. There is already talk of the three-day weekend and the one month vacation.(10) However, this gain in free time is certainly not evenly distributed throughout our population. Many busy executives today toil as long as their ancestors did. One survey of 1,700 top executives showed that one third work more than 55 hours a week.(11) There is perhaps some basis for the belief that the present trend is "Leisure for the masses and work for the classes."

It would be an error to assume that all of this possible increase in leisure time will be converted into pressure on the resource base for recreation. It is quite possible that much of it will be consumed by a program of advanced training activity sponsored by government and industry. In this age of rapidly developing ideas and techniques, many feel that there are decided advantages to *refresher* and advancement courses for executives and technicians. Recent legislation in some of the provinces is indicative of trends in this direction. Many will undoubtedly devote a very large percentage of their increased leisure time to the pursuit of the arts; music, painting, etc.(12)

However, it is certain that many will desire to utilize their leisure time in outdoor recreation pursuits of various types. Probably there will always be a large group whose interests in intellectual pursuits are decidedly limited. Moreover, many of those who will receive the blessings of this increased leisure time will not have been trained to use it in any other way than that in which they are normally accustomed. For this group it is known that outdoor recreation activities such as hunting, fishing and camping hold a strong attraction.(13)

(b) Increased Spending Power

The magnitude of the increase in personal expenditure by the Canadian people on consumer goods and services is dramatically revealed in the following table which indicates a rise of well over 50 per cent in the last decade.

Personal Expenditures on Consumer Goods and Services
(in constant 1949 dollars)
"000 Dollars"

Date	Total	Non Durables	Durables	Services	Gross National Expenditures	Percentage of Personal to Gross
1926	5,010	—	—	—	7,576	66.2
1929	6,490	—	—	—	9,061	71.6
1933	5,272	—	—	—	6,359	82.8
1939	6,510	—	—	—	9,536	69.4
1944	8,444	—	—	—	15,927	52.8
1948	10,451	6,253	954	3,244	15,735	66.5
1949	10,923	6,288	1,146	3,489	16,343	67.0
1952	12,633	7,016	1,526	4,091	20,027	63.3
1956	15,603	8,705	2,209	4,689	23,811	65.7
1959	17,163	9,726	2,259	5,178	24,763	69.5

Source: Dominion Bureau of Statistics, *National Accounts Income and Expenditure* 1926–1956, Table 5, p. 36, from 1948 onwards.

This table indicates a rough correspondence in the rise of gross national expenditure, which rose in the decade from 1949 to 1959 by 51.5 per cent in real terms, to the rise in total personal expenditures which rose by 57.1 per cent, while expenditures on *services* (as part of total personal expenditure) rose by 48.4 per cent during this period. The *recreational* expenditure component can be assumed to have risen at least as rapidly, and evidence may be adduced to indicate that it is rising at a relatively faster rate although we can only make rough *guesstimates*.

It is difficult to determine from available information what proportion of the expenditures for services is for recreation. It is virtually impossible to determine how much was for indoor and outdoor types of recreational activities and for facilities. Statistics furnished by family budget studies do not help us appreciably. Dominion Bureau of Statistics and other studies indicate that the recreational component could safely be estimated at about three per cent of the total family budget.(14) However, since the proportion of expenditures on durables for recreation (e.g. cottages) and non-durables (e.g. sports clothing) that fall into the recreation category cannot be accurately determined from available data, we must use these estimates as conservative indicators of relative trends only.

It should be noted that the approximate three per cent figure, stated by the Dominion Bureau of Statistics as that proportion of the family budget devoted to recreational expenditure, is based on a very limited definition of what constitutes recreational spending. A proportion of personal expenditure on such items as automobiles, general transportation, home goods, clothing and foods should also be classified as recreational in purpose yet for the most part these are itemized separately from the *recreation* heading.

If we take all those items which are mainly concerned with recreation and total them along with those already defined as recreational then we find that the proportion spent is over 14 per cent of the family budget rather than three per cent.(15)

The Commerce Department of the United States similarly underrates the importance of recreational spending. Although their list of *recreational* items is different again from that of the Bureau of Statistics they also leave out major items such as automobile expenditure. On their 1959 after-tax personal income of 336 billion they denote only 16 billions or 4.7 per cent as being spent for recreation.(16) This is far below that indicated by those who would take a broader definition of recreational spending. One such approach places recreational spending in the United States at the 41 billion dollar figure which is about 12.3 per cent of personal disposable income.(17)

From the above it would seem that national expenditure accounting has no clear definition as to what is a recreational item and what is not, and as a result the impact of recreational expenditure on our economy is likely being grossly underestimated. We obviously do not yet fully recognize such spending as being a major force in the national economy. This fact is glaringly evident by the almost total omission of comment on recreation spending in the studies by the Royal Commission on Canada's Economic Prospects.

The great gap in our existing statistical information on the economics of recreational spending provides a poor basis for prediction of future demand as it is related to changing economic conditions.

In his study for the Royal Commission on Canada's Economic Prospects, *Consumption Expenditures in Canada,* David Slater considers this problem of estimating expenditures for various goods and services and states quite clearly the conceptual and statistical difficulties involved, especially with respect to expenditure on recreation. He notes that "no systematic study of recreational expenditure in Canada is available" and relies in his estimate on "casual observation (which) suggests that Canadians are devoting larger and larger fractions of their expenditures and efforts to such activities".(18) For firmer ground, he refers in an earlier part of the study (page 30) to an analysis prepared for the *Conference on Consumption and Economic Development* by Irving B. Kravis. (19) This paper noted:

a) the close similarity in consumer expenditure patterns in Canada and the United States, (Canadian expenditure, however, on a lower level because of income disparity) and

b) "surprisingly little change in the distribution of consumer expenditure in U.S.A. during the last five decades".

This remarkable stability in the over-all pattern of consumer expenditure obscures the internal shifts which have revealed the "substitution of the automobile for housing and clothing".(20) as major items of expenditure. This has significance for us insofar as Canadian experience follows that of the United States, and insofar as it reflects the recreational use to which part of automobile expenditure might be attributed.

Weak statistical evidence must be supported by what Slater has referred to as *casual observation.* Yet it is clear that even without a past statistical trend to lean on to reveal rising per capita expenditures on recreation, total recreation expenditures in the next few decades will undoubtedly rise, if only as a consequence of stable per capita expenditure accompanied by increasing population.

The significance of rising income levels in relation to recreation expenditure lies in the increa-

sed opportunity they afford for the Canadian people to take advantage of the recreation potential of the resource base. It would be unwise therefore to assume from the stability of the expenditure patterns in the past that these relatively stable trends will continue in the future. There is enough evidence on the basis of *casual observation* to indicate that pressure has been building up which, with increased incomes and increased recreation opportunities, will result in a rising proportion of personal expenditures devoted to recreation, and we can fairly safely predict that this increase will be substantial. The phenomenal growth of private cottages, increased sales in outboard motors and boats and sale of camping equipment, suggest that there is already a substantial growth which has not yet reflected itself in statistical data on personal expenditure.

Because of the disparity of personal income and expenditure levels across Canada it would be dangerous to generalize about the regional impact of increased expenditures. In general terms it must be stressed that inferences drawn from past personal expenditure patterns are a very unreliable guide to the projections of demand and potential use of recreation resources but it is particularly so for projections on a regional basis and over a long period.

We have only a rough guide to regional variations in noting income level differences alone. Family budget studies provide some indication of the variation in the proportions of the budget devoted to recreation in different parts of Canada.[21] These differences can be partially attributed to differences in recreational opportunities offered by the resource base and to varying cultural factors affecting the level and manner of recreational activities across the country. If recreational opportunities are limited the demand may be only latent or *below the surface*. The demand will come forward possibly in an explosive fashion if this pressure of latent demand has been rising over a long period.

In these circumstances, increasing opportunities for recreational activities will bring forth more than a proportional increase in the use of recreational facilities. The introduction of reservoirs into arid areas is a particular case in point. With no facilities there is obviously little expenditure but it would be rash to infer that there is no *need* in the sense of a latent demand. Pressures simply build up until the explosive force of this demand is revealed when an outlet is provided as for example, the spectacular increase in expenditures on visits to such reservoir beach and lookout points as the St. Lawrence Seaway and the South Saskatchewan reveal. To this we can add the expenditure on cottages, boats, etc. arising out of the creation of a reservoir suitable for recreation use.

Secondly, the pattern of recreational expenditure may not reveal the changed pattern of activities as, for example, the increasing importance of low-cost camping vacations which has shown an almost spectacular rise in terms of use of parks and roadside camp-site facilities. This might be evidence of a cultural change (despite rather than because of income change) associated with technological innovations that have expanded recreational possibilities in terms of accessibility, mobility, equipment and facilities.

3. The Influence of Technology.

Technological changes have an important impact on the use of resources for recreation. Changes in transportation and the introduction of new equipment are steadily changing older concepts of recreation land potentials. These in turn create new demands in areas and in various types of terrain which never before were valued for outdoor recreation.

(a) Changes in the Mobility Factor.

The story of the automobile and the dramatic change it has effected in the leisure life as well as the everyday life of most North Americans is now well known. Nevertheless it would be well to review these changes and to consider their implications to the future. The growth in numbers of passenger cars alone from a handful in 1900 to over 3.5 million 60 years later is a phenomenon of this century. Probably close to 90 per cent of all recreational travel in North America is now by personal automobile and indications are that there will not be any important change in this pattern in the near future. So dominant is this mode of travel to our recreation places that we might tend to rate as unimportant the influence on recreational demand of travel by other sources.

There is good reason to expect that there will be many more cars on our roads and that the average annual mileage per vehicle will also increase under the impetus of more free time, more dollars to spend and better roads. The per capita holdings of automobiles in Canada are still only about 60 per cent of those in the United States.[22] Indications are that this gap is closing and at a faster rate than is the gap in per capita income between Canada

and the United States. Forecasts place the number of passenger vehicles at between eight and nine million by 1980 or about two and one half times today's number.(23) To this significant number of mobile citizens we must also add the *spill-over* from the United States, which even now is nine million vehicles a year with over two million remaining longer than 48 hours.(24)

Good roads are most important in their effect on mobility and ultimately on location and scale of demand for outdoor recreation areas. In later years road construction has been given a high priority by the various governments. The results of this policy are beginning to show. There are now about 300 thousand miles of surfaced roads throughout Canada with two-fifths of this mileage being added in the last ten years. Canada's per capita expenditure on roads has almost tripled within the last three years, to place it ahead of any other country in the world both with regard to outlay, per capita, as well as per vehicle.(24)

One of the most recent trends in road development in Canada is the entry of the federal government into a field that has always been considered a provincial responsibility. The results of this have been a telescoping of road building schedules in remote areas and particularly on Canada's first transcontinental highway. This cannot help but have a profound effect on demand for public recreation lands in these remote areas and along the route of the new Trans-Canada in regions which are quite distant from population centers. There is already evidence of response to anticipated demand in the federal-provincial Trans-Canada roadside park program. Eight of the ten provinces have joined in this program to date and a total of 56 roadside parks have been built out of a total of 106 planned.(25)

Also there are surveys in progress for new national parks in the Yukon and Northwest Territories where the federally assisted Roads to Resources programs are likely to bring more potential park lands within travel range of the touring motorist.

There has been a decrease in purchased transportation over recent years as compared with a very important increase in total personal travel. In current dollars expressed as a percent of consumer budget there has been an increase in personal travel of from 8.7 per cent between 1927 and 1929 to 12.3 per cent between 1952 and 1955.(26)

The decrease in personal expenditure on purchased transportation has not been the same with all forms of travel. The railroads have suffered the most to the direct gain of the airlines which have experienced a phenomenal growth. Expenditure on taxis has also increased at a greater rate than has expenditure on consumer goods generally.

The report on Consumption Expenditures in Canada makes some interesting forecasts on travel based on recent trends in Canada and the United States.(27) The essence of these is as follows:

1. The relative cost of long distance air travel will decline as the volume of traffic increases;
2. Fast public transportion plus taxi service in the downtown areas may be expected to grow in importance;
3. Railroad service on 200 – mile trips or overnight trips will likely continue to be very attractive;
4. Intercity travel on common carriers will likely increase at a steady rate.

Recent readjustments in airline fares which favor long distance travel but in effect penalize short trips to the advantage of the railroads, bear out some of the above predictions.

One might speculate on the future on the basis of the dramatic increase in expenditure on airline travel (a 30-times increase between 1930 and 1955), (28) the considerable increase in expenditure on taxi usage (a six-times increase between 1930 and 1955),(29) and the steady growth in U-drive vehicles with their strategic locations at air line and rail terminals. We might expect that as families see *all there is to see* within comfortable motor travel radius of their homes they may take to jumping the hurdle of distance by air and renting a car to explore the attractions of more exotic lands. This could become a popular means by which eastern populations of this continent could explore the west and vice versa without the tiresome, time consuming transcontinental drive.

Already this is becoming a popular means of visiting the British Isles and of touring the Continent, and much tourist advertising is presently orientated in this manner. If this trend were to develop it could mean that use of recreation places with national and international appeal would become less related to traditional holiday motor range than they are at present. It could also mean a further impact of use from presently distant populations and even distant countries.

(b) Improvement and Development of Equipment. Technological changes as expressed in improvement and development of recreational equipment

must also be considered with regard to the growing and changing demands on outdoor recreation space.

In recent years we have seen a phenomenal increase in boating activity which cannot entirely be attributed to the already discussed demand factors of population, leisure, income and mobility. Credit must be given to the very important improvement in methods of construction which have in effect resulted in more boats of a more reliable and more portable variety for less money than formerly. Improvement of the outboard engine has probably been as great a factor as any in this unusual surge of popularity for boating, but the maintenance-free plastic hulls and the light, efficient boat trailers have also been a tremendous boon to boating helping it to become one of the nation's top family sports.

Water skiing has been an outgrowth from the development of better boats. More power, higher speeds and better quality ski equipment all contribute to the growing demand by enthusiasts for space and facilities on our waterways along with other water-orientated recreationists.

The present mania for camping was also greatly stimulated by improved design and manufacture of equipment. The modern day camper is able to *rough it in luxury* due to improvements in tents, sleeping equipment, cook stoves, transistorized radio and a host of other facilities which the manufacturers provide specifically for this relatively new type of well heeled traveler.

Winter skiing received its great impetus from the development of uphill tows and lifts which reduced the physical effort required by making it a *downhill run all the way.* Improvements in winter clothing, both with regard to style and comfort, plus improvements in ski harness which reduce the danger of serious injury, have given the sport a further boost in popularity. Enthusiasts now predict skiing will become Canada's biggest sport with a five-fold increase by 1970. Growth in demand for a sport requiring such specialized equipment would have been quite unlikely without the contributions of technology.

No doubt we will see other great surges of demand in the years ahead for special types of terrain and special facilities as the combination of economic progress and technological advance brings types of outdoor activity formerly reserved for the few within range of the many. Some of these demands will die as quickly as they arise due to the shallowness of their offering to a population increasingly eager and able to try anything that promises challenge and change from everyday routine. Others will bloom and grow in popularity until they become great national pastimes affecting not only the leisure life of great numbers, but also the economy of regions fortunate enough to possess and wise enough to preserve the required land and water resources.

4. The Implications of Population, Income and Technology for the Resource Base.

The gross statistics for total population and rates of growth coupled with the marked pattern of regional concentration suggest that there is great need for an immediate and comprehensive survey of present facilities and possibilities for their expansion to meet future demands on a national and regional basis. It is evident that the problem of the allocation of resources for recreation uses is certain to be more difficult in some parts of Canada than in others and that dynamic action is required immediately in such areas as the St. Lawrence Lowlands.

The growth of urbanization will likely give rise to an increased appreciation of the out-of-doors and stronger and more organized efforts toward conservation of the nation's outdoor recreation areas and national beauty spots. It might be noted that organized effort to protect natural areas for recreation and enjoyment usually originates in the populated areas whereas those who are concerned with the wilderness for their immediate livelihood often resist such demands. This is one of the more hopeful aspects of a rapidly developing country which otherwise threatens to engulf natural beauty and outdoor recreation potentials in the race for utilization of resources.

Demand will grow immensely for the popular all-day park with beaches, picnic areas and plenty of surrounding natural area located within a 75-mile radius of these urban concentrations of population. One estimate of expected demand for all-day parks near urban areas in the United States places use in 1985 at 11 or 12 times that of 1955.([30]) If the same factors used for this prediction are analyzed here in Canada, it would seem that we could expect at least a 60 per cent increase, over this figure in the demand for these facilities, because of differences in population increase. This would mean use of these areas in Canada in 1985 would be 17 or 18 times that of the 1955 level. Predictions of this type do not seem so fantastic when we consider the increases in use of outdoor facilities we are currently experiencing.

Demand will grow at an even faster rate for those overnight and vacation areas lying beyond the day-travel range. In the United States it has been estimated there will be 30 times as many visits to the more remote vacation and overnight attractions in 1985 than in 1955.(31) An even more spectacular increase in use of the more remote recreation lands can be expected in Canada. A comparison of the rate of increase in national parks attendance for the two countries tends to support this. Average rate of increase of attendance at Canada's national parks is 12 per cent (32) as compared with eight per cent in the United States.

A considerable proportion of this expected demand will likely be accommodated on existing large land reserves through their more intensive development. However, it is quite clear that our existing national and provincial park systems must be greatly expanded if they are to meet the demands of the future. Those provinces which have yet to set aside a large park system will have to move fast if they are to look after the happiness and welfare of their future citizens and if they are to avoid becoming a holiday deficit region in the future.

All outdoor areas have a definite capacity which if consistently exceeded will result in a steady deterioration of the natural attractions. Increased demand of the type envisaged cannot long be met by the expansion of services within any one park no matter how large that park may be. There must be an additional reservation of lands which possess adequate recreational potential.

Since age is a determining factor in the capacity or desire of individuals to take part in recreation activities the significant changes in the age structure of our total population mentioned above will greatly influence the scale and type of demand. The trends discussed suggest that there will likely be a continuing demand for family-type recreation opportunities. The demand will also grow for areas suited to active recreation such as skiing, beach use and boating. Activities and pastimes associated with a young population are very much orientated about the *wide open spaces* which again points up the need for adequate reservation of suitable park lands before they come under uses which could destroy their recreation potential.

The demands of the growing older-age group will be for the less active forms of outdoor recreation and consequently may be met largely through the more formalized urban park systems. It may also result in an extension of the season in provincial and national park systems because these older people have fewer ties and a wider choice for their holidays, and they will likely seek to avoid the growing congestion during the school holiday period when the full impact of our burgeoning younger segments of the population will be felt.

The massive demand for outdoor space growing out of high income is already very real in the United States. It is only just beginning to be felt here in Canada. In a very few years these outdoor activities which are characteristic of a moneyed society will undoubtedly exert a powerful and growing demand for space and facilities in many regions throughout Canada. The phenomenal growth in family camping in just the last few years is a case in point, as is the trend toward greatly increased boating and skiing activity. All of these involve fairly high expenditures of the *discretionary dollar* and indicate that there is a definite relationship between growing personal income and the demand for outdoor recreation space.

The truly significant feature of the growing proportion of free time available to such large numbers is its likely effect on travel range and the greater opportunity it affords to provide usable recreation space in the broad terrains now lying outside practical weekend or vacation commuting distance from our population centers. This feature again points out the need for long range planning of our land resources and the full recognition of recreational potentials in regions which today would appear to have little relationship to popular demand.

It is highly probable that an extra week or two of holiday time in the United States will have its impact on the vacation lands of Canada. As one writer suggests, "(There will be) a large spill-over from limited recreation resources into Canada of a size and also a character that Canada has never experienced before".(34) This spill-over from the United States is certain to come regardless of the extended holiday factor. Canada's brisk summer climate, traditional outdoor attractions and its very proximity to the richest and most mobile nation on earth make it an ideal outdoor vacation land for the increasingly urbanized society south of our border. American visitation to Canadian national parks now represents 18 per cent of the total and in the last ten years has increased by two and one half times.(35)

Increased holiday time coupled with high income will, of course, have a growing influence on intercontinental travel which could affect the demand for outdoor areas in Canada which have international appeal.

In terms of international visitation Canada and the United States are already tourist deficit countries with far more tourists leaving our shores for exotic lands than entering our respective countries. This is understandable, considering the difference in personal wealth between North America and most other countries along with the very favorable rate of exchange for the dollar. Whether this situation will reverse in the foreseeable future is a matter of speculation. In any event, this difference between outgoing and incoming tourists to this continent would not seem to be too significant in reducing the total demand.

In nearly all cases opportunity for outdoor recreation experience is directly related to the availability of land and water areas. Without such space of the right type in the right places demand will be frustrated and the good life that promises for the future could degenerate into a mass of congested mediocre activity. As we have seen, demand on a scale which almost belies imagination seems inevitable. Every social and economic factor points that way. There is growth in every direction and demand for outdoor recreation space will grow as a result of the compounding of many of these factors.

What we cannot dare forget is that there is apparently no foreseeable limit to this demand for outdoor living space but there most certainly is a limit to the lands and waters which can meet these demands. The welfare and happiness of all future generations could well depend on how well we utilize and manage our precious heritage of land and water over the next few decades.

Notes and References

[1] This projection is based on the assumption that there will be 75,000 immigrants per year and other factors — See Royal Commission on Canada's Economic Prospects, *Final Report*, Chapter 6, Table 6.2, p. 107. November 1957.

[2] Pleva, E.G., *The Basic Need For Recreational Land.* A paper presented to a Seminar on Parks and Nature Preserves in Ontario, Toronto. September 21, 1960.

[3] Dominion Bureau of Statistics, *Canada 1960.* p. 43.

[4] Perloff, H.S. and Wing, L., Jr., *Natural Resource Endowment and Regional Economic Growth.* Background paper for conference on Natural Resources and Economic Growth. Ann Arbor, Michigan. April 1960. p. 11.

[5] Royal Comission on Canada's Economic Prospects, *Final Report*, p. 365.

[6] Stamp, L. Dudley, *Our Developing World.* p. 183.

[7] Bank of Montreal, *Business Review.* February 23, 1960.

[8] Bank of Montreal, *Business Review.* February 23, 1960.

[9] Taylor, G.D., *Characteristics of the Population of British Columbia*, a paper presented to the 9th Annual B. C. Natural Resources Conference. February 1956.

[10] Royal Commission on Canada's Economic Prospects, *Final Report*, p. 325, where it is estimated that the work week for the industrial labor force will be 34.3 hours by 1980.

[11] Editors of Fortune, *Markets of the 60's*, p. 198.

[12] The range of leisure time activities is more fully discussed in *The Social and Cultural Aspects of Recreation*, a paper prepared by J. Farina for the 1961 "Resources for Tomorrow" Conference.

[13] Taylor, G.D. and Edwards, R.Y., *A Survey of Summer Visitors to Wells Gray Park*, British Columbia, Reprint from the Forestry Cronicle, December 1960. Vol. 36, No. 4. An interesting analysis of wild land use which bears on this subject.

[14] Due, John Mann, *Consumption Levels in Canada and the United States*, Canadian Journal of Economic and Political Science, May 1955, D.B.S. *Consumer Price Index Series and City Family Expenditure* and especially the recent (April, 1961) revision for the weighting for the calculations of the Consumer Price Index which gives "recreation" a higher weight.

[15] Dominion Bureau of Statistics, *City Family Expenditure 1953*, Queen's Printer. To obtain this figure all items which are primarily recreational in nature were selected from the various headings of Table 4 pp. 18-33. For some items such as *automobiles*, which have multiple purposes, a percentage of the listed expenditure was taken and added to the total. This still excludes many items such as clothing for which it is most difficult to estimate the proportion related to recreation. It also excluded liquor and tobacco which might be considered as socially unacceptable under the category of recreation.

[16] Editors of Fortune. *Markets of the Sixties*, pp. 190, 191 Harper and Brothers, New York.

[17] Ibid.

[18] Slater, D. W., *Consumer Expenditure in Canada*, Royal Commission on Canada's Economic Prospects, May 1957. p. 165.

[19] Kravis, Irving B., *International & Intertemporal Comparisons of the Structure of Consumption*, National Bureau of Economic Research Conference on Consumption and Economic Development. October 21—22, 1958.

[20] Kravis, Irving B., *International and Intertemporal Comparisons of the Structure of Consumption*, National Bureau of Economic Research on Consumption and Economic Development. October 21-22, 1958.

[21] Dominion Bureau of Statistics, *City Family Expenditure, 1953*. 1955.

[22] Slater, D.W. *Consumption Expenditures in Canada*, Royal Commission on Canada's Economic Prospects. May 1957. p. 133.

[23] Slater, D.W., *Consumption Expenditures in Canada*, Royal Commission on Canada's Economic Prospects. May 1957. Table 55, p. 141.

[24] Bank of Montreal, *Business Review.* November 25, 1960.

[24] Ibid.

[25] Department of Northern Affairs and National Resources. *Trans-Canada Highway Campgrounds and Picnic Areas Program* - summary of progress prepared in December 1960.

[26] Slater, D.W., *Consumption Expenditures in Canada*, Royal Commission on Canada's Economic Prospects. May 1957. p 148.

[27] Slater, D.W., *Consumption Expenditures in Canada*, Royal Commission on Canada's Economic Prospects. May 1957. p. 151.

[28] Slater, D.W., *Consumption Expenditures in Canada*, Royal Commission on Canada's Economic Prospects, from Table 61, p. 149.

[29] Ibid.

[30] Clawson, Marion. *The Dynamics of Park Demand* R.P.A. Bulletin 94. April 1960. p. 38.

[31] Clawson, Marion, *The Dynamics of Park Demand* R.P.A. Bulletin 94. April 1960. p. 38.

[32] From unpublished records of National Parks Branch, Canada.

[33] Clawson, Marion, *Statistics on Outdoor Recreation.* 1958. R.F.F. p. 26.

[34] Rausenbush, S., *Do Resource Regions Meet Peoples Needs*, paper to 20th N.A. Wildlife Conference. 1955.

[35] From unpublished records of National Parks Branch, Canada.

Bibliography

[1] Slater, David W., *Consumption Expenditures in Canada,* Study for Royal Commission on Canada's Economic Prospects, Queen's Printer. May 1957.

[2] Hood, Wm. C. and Scott, Anthony., *Output, Labour and Capital in Canadian Economy,* Study for Royal Commission on Canada's Economic Prospects, Queen's Printer. Ottawa. February 1957.

[3] Royal Commission on Canada's Economic Prospects, *Final Report,* Queen's Printer. Ottawa. November 1957.

[4] Clawson, Marion., *Statistics on Outdoor Recreation,* Resources for the Future Inc., Washington, D.C. April 1958.

[5] Clawson, Marion., *The Dynamics of Park Demand,* Regional Plan Association, Bulletin 94. New York. April 1960.

[6] Dominion Bureau of Statistics, Ottawa, *National Accounts. Income and Expenditure 1926-1956,* Queen's Printer, Ottawa.

[7] Dominion Bureau of Statistics, *Canada 1960,* Queen's Printer. Ottawa,

[8] Dominion Bureau of Statistics, *Taxation Statistics 1959,* Queen's Printer. Ottawa.

[9] Annals of the American Academy of Political and Social Science. *Recreation in the Age of Automation.* Philadelphia. 1957.

[10] Brockman, C. Frank., *Recreational Use of Wild Lands,* McGraw-Hill Book Co. Inc. 1959.

[11] Stamp, E. Dudley., *Our Developing World,* Faber & Faber, London. 1960.

[12] Haig-Brown, Roderick., *The Crisis in Outdoor Recreation.*

[13] Pleva, Dr. E. G., *The Basic Need for Recreational land,* (12, 13 — papers presented to the Seminar on Parks and Nature Preserves in Ontario, Toronto. September 21, 1960)

[14] Taylor, G.D., *Characteristics of the Population of British Columbia,* (paper presented to the 9th Annual B.C. Natural Resources Conference, 1956)

[15] Parks Branch, Ontario, *1959 Statistical Report,* mimeographed Branch report.

[16] National Parks Branch, Canada, *Statements on Visitors to National Parks,* mimeographed Branch records.

[17] Bank of Montreal, *Business Review,* February 23, 1960, International Department, Head Office, Montreal.

[18] Bank of Montreal, *Business Review,* January 26, 1961, International Department, Head Office, Montreal.

[19] Editors of Fortune, *Markets of the Sixties,* Harper and Brothers. New York. 1960.

[20] Williams, W.R., *Recreation Places.* Reinhold Publishing Corp. New York. 1958.

Tourism in Relation to Natural Resources

H. L. Crombie,
Research, Markets and Surveys,
Canadian Government Travel
Bureau, Ottawa.

Tourism has valuable attributes as a social and economic force both nationally and internationally but little is known about its more definitive characteristics in Canada, especially about its effect on and demand for natural resources.

The tremendous growth of tourism in Canada is exerting a growing pressure on existing facilities, particularly because most foreign travelers and Canadians tend to frequent the same area which lies like a belt just north of the International Boundary.

All these factors indicate that extensive research is required if the impact of tourism on Canada's natural resources is to be assessed realistically. Foreign tourists' demands in this sphere warrant a more definitive analysis with this purpose in mind. Domestic travel research should be established on a national basis with the aid of the provinces so that it may be of value to all levels of government in determining resource-use and in enabling resource-planning.

Furthermore, local or municipal governments should be encouraged to assess their recreational preserves to ensure that sufficient reservations of natural areas have been made for future use.

Annual compilations of the Dominion Bureau of Statistics on United States travel to Canada reveal useful economic data on volumes, points of entry, expenditures and reasons for travel. However, these tabulations like the market and motivation studies of the Canadian Government Travel Bureau contain little material related to the use of natural resources.

There is even less information available on domestic travel by Canadians and while some research has been done by certain agencies, this research work has generally been sporadic and limited to studies of local economic impact. The statistics that have been gathered, such as entries into Federal and Provincial parks, and National Historic Parks, the number of hunting and fishing licences issued by the provinces, and the isolated provincial tourist surveys, also contribute little to an analysis of demands on the natural-resource base. They are even less useful in enabling the planning of future resource-development for tourism.

Tourism has become a significant and integral component of the total pattern of leisure activities in Canada. This travel is both national and international in scope, and involves the movement of millions of people from one Canadian region to another or across the International Boundary and the seven seas. Its largest aspects embrace travel between and within the provinces, and between Canada and the United States but worldwide voyages are also an extensive factor. In all of these categories the trip may be for an extended period of time, or it may be simply an afternoon or day-long drive through the local countryside to enjoy the colors of autumn or the blossoms of spring.

The rapid growth of the travel movement in recent years has been activated by the same forces that have engendered the phenomenal expansion of recreation as a whole. Prominent among these are the growth of disposable income, the greater ease of transportation in the air and on the expanding highways, as well as increased leisure time through shorter working hours, longer vacations and earlier retirement.

1. Social and Economic Dimensions of Tourism

In recent years there has been a marked emphasis on the economic aspects of tourism and this has frequently tended to obscure the social qualities it possesses. Both are important and the attributes of each deserve closer examination to ensure a balanced perspective.

The social dimensions of tourism are of vital significance for the individual and the nation. Travel satisfies the innate curiosity about the cultural and scenic treasures of the world, offers the opportunity

for renewing family associations and acquaintances, permits the enjoyment of sporting activities, and frequently provides the means for the recuperation of health.[1] It contributes substantially to the attainment of a broader and more sympathetic appreciation of problems in different parts of Canada and the world that enhance national unity and the spirit of international co-operation.

However, the tangible results of tourism in the form of travel spending are better known and they have a great impact on national and international economics. Some nations like Switzerland have realized for decades that tourist income based on the advantage of the resources of the country is the mainstay of their economies and a nation like the United Kingdom, which is a relative newcomer at tourist inducement, finds foreign tourists supplanting the former leading export — motor cars — as the principal source of dollars. Projected from present trends, the future should see an acceleration in the volume of international tourism of dramatic proportions. It could be a veritable economic explosion.

The Dominion Bureau of Statistics figures disclose that foreign travel income has a far-reaching effect on the Canadian economy having contributed over $300 million to the national purse each year since 1952 and, in reaching an estimated $391 million in 1959, established a new record. But the full effect of its influence is much greater, for the United States Department of Commerce has estimated that the initial injection of tourist-dollars to an area or a nation can sometimes be multiplied 3.2 times in economic effect as the new dollars pass from hand to hand.[2] Assuming a similar impact, the impetus given to the Canadian economy by foreign tourist spending in 1959 exceeded $1.25 billion. Additionally, travel income has accounted for almost six per cent of Canada's current income in the balance of international payments in each of the past 12 years.[3]

DBS statistics also reveal that almost 90 per cent of the 1959 income was derived from Americans, nearly five million of whom stayed more than 48 hours while spending $267 million. Another $84 million was earned from about 25 million other Americans during visits of less than two days. Additionally, Canadians earned $40 million in 1959 from long-term tourists from other countries. The socio-economic impact of this travel to Canada in 1959 calculated in visitor-days was probably equivalent to raising the population by an additional 44 million for one day.

It is to be noted that not all provinces share equally in this largess, however, and the chief benefactors are those closest to densely populated regions of the U.S.A. It is worth noting, too, that these same regions are abundantly endowed with such accessible natural resources as lakes and forests.

The following table, derived from the DBS data on provinces of entry, indicates the earnings from U.S. tourists by the regions and provinces in 1959, when $297 million were garnered by three leading provinces. The remaining $54 million were divided almost equally between provinces in the Atlantic Region and the Prairies although the earnings varied from one province to another.

PROVINCE	1959 EARNINGS (million dollars)
Ontario	185.0
Quebec	57.6
British Columbia	54.8
Atlantic Provinces	28.1
Manitoba	9.8
Saskatchewan	5.3
Alberta	10.5
Total U.S. earnings	351.1

Tourism as a vehicle for the stimulation of economic activity in underdeveloped or depressed areas has attracted considerable attention in recent years. This was, for instance, the reason for the special Atlantic Provinces Advertising campaign established by the Federal Government in 1956-57 and continued annually by the Canadian Government Travel Bureau.

Some provinces have tried with varying success to gauge the economic influence of tourists within selected areas but few have done it as well as Ontario which has surveyed the impact on five communities in the last three years.

To take one example from this list, the survey in Bracebridge, Ontario, in 1959 gave some indication of the economic effects of tourism on the local economy. During that summer, non-resident spending accounted for 57 per cent of retail sales in the community during the survey week, and total visitor purchases over a seven-week period were estimated at $458,000. It was calculated that this visitor-spending was equivalent to a year-round industry employing 114 persons.

2. The Importance of Canadians in the Tourist Pattern

While the American Traveler is of great significance in the tourist pattern of Canada in both a social and an economic sense, and while it is desirable to attract more and more of these visitors, the importance of Canadians is pre-eminent in the national tourist picture.

A leap in the attendance at provincial parks is noted in the following table. It is significant that Ontario and British Columbia which have had a progressive development program for their parks over many years and have made them available to the public, show a much higher rate of visitor-growth than Quebec and some of the Atlantic Provinces where attention is belatedly being given to these natural assets.

It is notable that Ontario, in 1959, accommodated more visitors in 71 parks than did the National Parks. In the three years from 1957 to 1959 this park attendance rose more than 142 per cent while campers tripled in number.

It may well be that campers account for much of the upswing in park attendance in some provinces. Certainly those provinces that have assiduously encouraged camping show the greatest increases.

Entries into Some Provincial Parks
(Data provided by Provinces, October, 1960)

Province	Year	No. of Visitors	Comments
Prince Edward Island	1958	3,000	Counted
	1959	5,000	only on
	1960	10,000 (a)	Sundays
Quebec	1955	180,824 (b)	
	1959	180,134 (c)	
Ontario	1957	2,114,700 (d)	
	1959	5,127,200 (e)	
Manitoba	1959	500,000	(estimated)
Saskatchewan	1959	214,178	
Alberta	1954	380,000	(estimated)
	1958	1,100,000	
British Columbia	1954	900,000	Approximate
	1959	2,700,000	figures

(a) to mid-August only
(b) includes 45,600 guests and 135,200 transients
(c) includes 87,600 guests and 92,500 transients
(d) total of 39 parks — 163,000 campers
(e) total of 71 parks — 479,000 campers

What is worth noting is that Canadians seem perennially appreciative with their own parks — be they national or provincial — and this is a condition worth maintaining. For if they ever reach the stage where they cannot find space and acceptable recreation in Canadian parks, Canadian travelers are very likely to cross the border and patronize competing areas in the United States. The inability to retain domestic travel income, and the concurrent drop in foreign income that would naturally occur, would have a very damaging effect on Canada's travel industry and balance of international payments — an effect far more costly than that of keeping parks and the general recreational *plant* in acceptable condition.

The dominance of Canadians is to be seen in the following table which breaks down entries into National Parks into *Canadian* and *Foreign* to disclose the consistently high percentage of Canadians using these areas over the most recent six years.

Entrants Into National Parks of Canada
Fiscal Years 1954 — 55 to 1959 — 60

Fiscal Year	Canadians		Foreign		Total
	Number	%	Number	%	
1954-55	2,397,959	79	637,042	21	3,035,001
1955-56	2,680,656	81	662,493	19	3,305,149
1956-57	2,870,571	82	659,405	18	3,529,976
1957-58	3,250,415	82	690,296	18	3,940,711
1958-59	3,591,983	84	695,360	18	4,287,343
1959-60	3,788,493	81	837,479	19	4,625,972

Source: National Parks Branch, Ottawa

Canadians are their own best customers.[4] This undoubtedly, is true for provinces taken individually.[5]

In the previously mentioned surveys carried out in various Ontario communities it was revealed that Canadian vacationers outnumbered Americans by seven to one. In the Bracebridge area 85 per cent of the 10,000 tourists lived in Ontario, and 54 per cent resided in the Toronto district.

Nova Scotia, in 1960, set a precedent among the provinces by publishing a comprehensive survey of tourists which is most useful in assessing the importance of interprovincial travel to that province.[6] From the research viewpoint it is regrettable that other, similar provincial surveys do not exist. A detailed check at highway points in Nova Scotia showed Canadian cars forming 65 per cent of the total. Over 85 per cent of the Canadian traffic surveyed originated in Ontario (58 p.c.) and Quebec (27 p.c.).

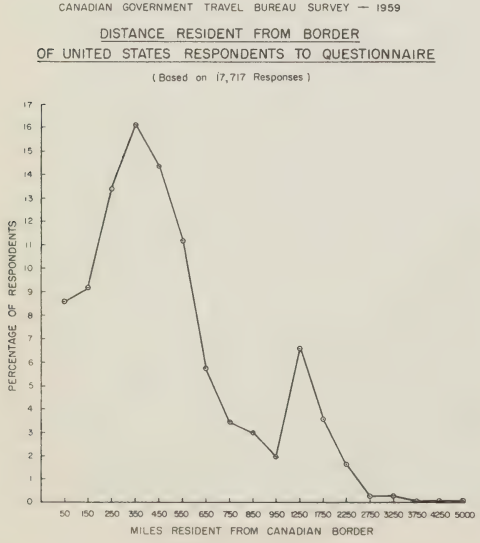
The attendance at provincial parks should naturally reveal a high percentage of provincial users. Although data are not available from all provinces of Canada, the findings in Newfoundland and Saskatchewan were strikingly similar. The attendance at roadside parks in Newfoundland during 1960 disclosed 90 per cent of the cars carried provincial licence plates, seven per cent were from other provinces, and only three per cent from the United States.[7] In five Saskatchewan provin-

cial parks, residents of the province comprised 91 per cent, other provinces seven per cent, and United States citizens two per cent.[8]

In this table the high ratio of Canadians rose from 79 per cent in 1954-55 to 84 per cent in 1958-59. In 1960 it was 81 per cent.[9] Now, this preponderance of Canadians in the tourist pattern has far-reaching implications for the planning and development of the resource-base for recreation purposes. In the first instance, Canadian needs should be the pre-eminent consideration. While accommodation can be made to meet foreign tourist requirements it cannot be allowed to dominate the entire planning process. Moreover, if attempts are made to approximate American park conditions too closely much of the attraction of Canada will disappear for these people. While there is a great similarity in the standard of living between the two nations, and while there is a marked coincidence in the recreation activities enjoyed, there are differences in Canada which can be effectively capitalized to provide a unique flavor for the American traveler. In large part these differences that can be effectively exploited are directly related to subtle variations in the resource base and its method of presentation.

3. The Uneven Impact of Tourism Upon the Resource Base

The American tourist and the Canadian vacation traveler exert a very uneven pressure on the total resource-base of Canada, and this varied impact has some implications for the utilization of natural resources.



Through its travel survey in 1959 the Canadian Government Travel Bureau discovered that the average American tourist who visited Canada lived within 450 miles from the Border.[10] It was also observed that the greater the distance an American had to travel to reach his destination in Canada, the greater was the fall-off in numbers. This figure, of roughly 450 miles, that an American vacationer is willing to travel to his destination has been noted in other independent surveys and is applicable to domestic travel by Americans as well. Available Canadian data indicate a similar pattern and it is one of the important hidden factors that must be recognized when assessing travel into and within Canada.

It is reasonable, therefore, to assume that the farther a traveler must venture for his holiday, the more reluctant he will be to undertake the long trip, and the more likely he will be to seek some area near his home that fits within his 450-mile vacation zone. The logical conclusion is that the primary interest in Canada of most American vacationers is in those areas lying like a belt along the Border and containing the desired attractions. Foreign travel within this belt is very unevenly distributed as indicated in the accompanying table showing the volume, the points of entry, and the destination of American visitors to Canada. Moreover, those provinces which receive the larger proportion of the tourist traffic tend to hold the vast percentage of it within their own borders.[11]

This belt and its points of tourist concentration coincide roughly with the area containing the heaviest concentration of Canadian population. It is here that Canadians are making the most intensive demands on the resource base for recreation outlets and these pressures on this area are certain to increase. Canadian population in this belt, particularly in the St.Lawrence Lowlands, is growing at a remarkably fast rate and the urban component is becoming increasingly pronounced. American population increases in the next 40 years are almost certain to be substantial and the demand for natural resources for recreation uses, particularly water, will increase tremendously.

According to a review of natural-resource conservation measures in the United States, only California among all of the States in the Union has a general plan for the conservation and development of the State's natural resources to meet the present and future recreational needs of its residents.[12] The findings of the California committee responsible for this thorough three-year study of resources indicate a startling pic-

ture of an exploding population within the state borders and the rapid diminution of the resources and areas available for necessary recreational pursuits. The present evidence of sprawling, haphazard growth in many major cities leads to the conclusion that in that time the face of the United States will be "splotched with 23 gigantic cities of two million people or more some of which will be vast city complexes ... and four-fifths of the U.S. population will be city dwellers."[13] Most of the future growth is forecast for the highly congested areas of the north-central and northeastern states which is precisely the area from which the majority of American visitors to Canada are now drawn.

The foregoing facts with respect to location of the major tourist impact on the Canadian resource base, and the forecasts of a compounding of population growth bring the need for long-range land-use planning and development for recreation sharply into focus. The belief of some Canadians that their country is endowed with such a combination of limitless space and low population densities that resource planning is unnecessary for many years is in need of a critical revaluation. A progressive plan for land use cannot be delayed for long.

Failure to adopt adequate planning measures and to provide the necessary resource base for tourism can result in a serious loss of recreation opportunities for Canadians. Moreover, it can have adverse repercussions upon the volume of American tourists entering Canada for, as mentioned earlier, the farther a traveler must venture for his holiday the more reluctant he will be to undertake the long trip, and the more likely he will be to seek some area near his home that fits within his 450-mile vacation zone. The logical conclusion is that the primary interest of most American vacationers is associated with those areas of Canada containing desirable attractions within easy reach of the Border.

In more definitive terms these findings indicate that existing recreational areas close to the Border such

Destination Reported by Motorists from the United States After Remaining Three Days or over in Canada, Special Survey 1958

Province of destination in Canada	Province of Entry into Canada									Number of Vehicle Entries (a)
	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon Territory	
	%	%	%	%	%	%	%	%	%	
Newfoundland	0.19	0.87	0.06	0.03	—	—	—	—	—	
Prince Edward Island	3.53	9.66	0.13	0.04	—	—	—	—	—	12,018
Nova Scotia	74.72	36.57	0.61	0.33	—	—	—	0.02	—	
New Brunswick	4.65	35.01	0.52	0.18	—	—	—	—	—	73,678
Quebec	2.97	12.72	82.72	11.52	0.27	—	0.09	0.06	—	185,951
Ontario	0.74	1.97	8.36	84.43	7.43	1.11	0.36	0.22	—	591,159
Manitoba	—	—	0.02	0.78	71.89	4.88	0.72	0.28	—	26,043
Saskatchewan	—	—	0.02	0.08	6.62	66.30	2.33	0.73	0.61	14,549
Alberta	—	—	0.06	0.29	6.89	18.18	63.41	10.31	0.61	31,080
British Columbia	—	0.04	0.15	0.11	3.38	2.22	10.94	82.15	0.61	143,217
Yukon Territory	—	—	—	0.11	—	—	0.27	0.14	1.83	3,738
Northwest Territories	—	—	—	—	—	—	—	0.06	—	
Touring (no destination specified)	13.20	3.16	7.31	1.91	1.76	0.88	7.26	2.27	—	
In transit (b)	—	—	0.02	0.05	1.76	6.43	14.26	3.62	—	
In transit (c)	—	—	0.02	0.24	—	—	0.36	0.14	96.34	
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	1,081,433

(a) Table 5, p. 79.— "Number of non-resident automobiles entering Canada on Customs Permits through province of entry, and departing after remaining three days or over".

(b) In transit to Alaska

(c) In transit to United States

NOTE: The percentages in this table were gathered in the Special Survey and may not be strictly applicable to the total vehicular traffic in the right hand column and which is shown for information purposes.

as Quetico, the St.Lawrence Seaway parks, Georgian Bay Parks, and those in other provinces must be carefully preserved. There is also an indication from the traffic in these regions that additional sites should be added near the high-population centers as has been done in many areas of the United States such as on Long Island and around Lake Champlain.

The foregoing emphasis on the belt of resources situated fairly close to the International Boundary is not intended to imply that more northerly areas have no part to play. Although recreation facilities farther north in Canada are not yet in as great demand as those to the south, the spread of population in Canada and the increasing mobility of all North Americans will place a greater demand on these areas in the future. It seems almost mandatory that plans be laid now for reserving acceptable tracts of land farther from the Border for future recreational pursuits. There is some endeavor to meet this challenge as present Federal plans contemplate two northern parks, one in the Yukon and one in the Northwest Territories. In the years to come, these can be developed to permit an even wider range of pleasure and relaxation for all travelers.

4. The Significance of Scenic Landscape for Tourism

Unlike many areas of the world whose appeal lies mainly in exotic ways of life or the lasting symbols of history, art, and architecture, Canada's perennial attractiveness seems closely bound to the scenic wonders of the natural landscape. While Canada is not without historic monuments of interest to the Canadian and the American tourist (as will be noted subsequently) the scenic quality of the resource base has probably been the prime attraction contributing to the steady growth in travel to Canada over the years and almost an explosion in domestic travel in the past 15 years.

The significance of a scenic appeal for the American tourist is indicated by a continuing study carried out by the recently expanded research of the Canadian Government Travel Bureau. It was found, in 1959, that American tourists decidedly preferred *beautiful scenery* in advertising pictures over such things as fishing scenes and resort photographs. This finding was amply borne-out by the response to two scenic National Parks ads in 1960, which obtained the highest coupon-returns ever recorded in the Bureau. This preference for natural beauty was further accentuated when the 1959 and 1960 tourists declared their most absorbing activity to be "sight-seeing outside of cities".

Despite the lack of extensive data about Canadian preferences it is probably safe to assume that scenic beauty holds a similar attraction for the Canadian tourist when traveling about various parts of Canada. A recent study based on a one-per-cent random sampling of the population by mailed questionnaire in Saskatchewan revealed that over 300,000 tours were made into the open countryside in the spring of the year and 50 per cent of the travelers drove simply to enjoy the scenery. In a question in this survey pertaining to the attractions of the provincial parks in Saskatchewan, 38 per cent of the respondents indicated that scenery was the important factor, 25 per cent listed fishing and sports.[14]

In a recent survey conducted in Wells Gray Park 40 per cent of the visitors indicated that their major reason for visiting the area was associated with scenery. Another 19 per cent gave wilderness atmosphere as their major interest.[15]

In view of the significance of scenic beauty to both the Canadian and American tourists, indeed to the whole experience of living, it is essential that the development of Canada's resource-base proceeds in an orderly manner with significant recognition of landscape values. It becomes important, therefore, to avoid the butchering of the natural scenic heritage that is often associated with resource exploitation, engineering works and haphazard urban sprawl.

This desecration of the landscape is often condoned by authorities at all levels of government who could legislate against the wanton destruction of scenic values. All too frequently town garbage dumps and used-car graveyards are permitted to blight the urban landscape when they could be concealed; abandoned gravel pits yawn alongside public highways, and deserted sawmills rot away on open ground. By ensuring that the selfish wishes of a few despoilers are kept under reasonable control, public officials could make certain of a more pleasing landscape in urban and rural areas.

Effective planning and development measures against these abuses are necessary, not only in the interest of tourism, but, as well, for the preservation of pleasant surroundings in the fundamental pattern of daily life.

5. The Significance of Wildlife for Tourism

Wildlife is an essential part of scenic beauty for it animates what often is a barren scene. Its important role in nature's realm has long been recognized by appreciative humans who have legislated protective measures and founded conservation bodies to perpetuate its vital influences. Wildlife also plays a distinctive role in the realm of tourism and can be considered in relation to two distinct interest groups: those devoted to hunting and fishing, and the naturalists. Al-

though the immediate objectives of these two differ it must be noted that both have an ultimate interest in the preservation of wildlife values. Although it is difficult to estimate the number of people who are induced to travel about the country to observe and photograph various forms of wildlife, some appreciation of those interests in Canada might be gained from the fact that the Canadian Audubon Society has 5,000 senior and 40,000 junior members in 16 affiliated organizations. There are, as well, 46 member clubs in the Ontario Federation of Naturalists with 3,200 senior and 4,500 junior members. In Quebec there are also about 500 youth naturalist clubs with an average of about 30 members each. As a rough estimate there are probably about 13,000-15,000 senior members and 75,000 junior associates in all of these organizations across Canada.

Probably only a small number of Canadians plan long trips primarily for the observation of wildlife but, for the majority of travelers, wildlife values are often an added and important attraction, and many people will undertake diversionary trips from a main route for these purposes. Undoubtedly thousands of miles are traveled each year by naturalists in local areas to observe birds and animals either individually or as part of club activities.

As proof of the importance of observing wildlife it has been noted that attendance at wildlife refuges in the United States increased from 3,143,000 visitor-days in 1951 to almost nine million visitor-days in 1960. In 1960 only about four per cent of the visits were for hunting purposes on 69 of 270 refuges where this activity is permitted. Another 36 per cent of the visitor-days were devoted primarily to fishing. The remaining 60 per cent were devoted to the observation and photography of wildlife, frequently in conjunction with a family picnic or swimming.[16] Data of this type are not available for a comparable assessment of the Canadian situation but the Jack Miner Bird Sanctuary in Ontario has about 10,000 visitors on a peak day. In many of the provincial and Federal parks, wildlife attractions are playing dominant roles in outdoor activities with a heavy schedule of guided tours available for summer visitors.

The importance of fishing and hunting in the promotion of travel is well known. The following table, compiled from data supplied to the Canadian Government Travel Bureau by all of the provinces, indicates the number of fishermen and hunters who pursue their favorite sport, often in remote areas of the country. It reveals the growth in these activities over a five-year period but it should be noted that no allowance can be made for the large numbers of anglers in such provinces as Ontario who are not required to obtain a licence unless they fish in a provincial park.

In the six years from 1954 to 1959, Canadian provinces collected a total of $49 million from hunters who increased 24 per cent in number during the period, and licensed anglers whose ranks rose nearly 50 per cent.

These large numbers of non-resident fishermen, no doubt, are the underlying reason for *fishing* being rated perennially as the fourth most absorbing activity of American tourists as revealed in the annual Travel Bureau surveys.

Hunting and Fishing Licences
Issued in Canada, 1954 and 1959

Year	Fishing Licences		Hunting Licences	
	Number	Revenue	Number	Revenue
1954 Resident	350,680	$ 484,400	995,374	$2,547,000
Non resident	495,760	2,794,900	36,384	971,000
1959 Resident	594,323	867,000	1,324,300	4,116,000
Non resident	671,205	3,200,000	40,673	1,329,000

Source: Provincial Departmental Reports.

As angling and hunting both depend on the conservation of natural areas, the 1959 revenue of over $9.5 million from licensees could be used to offset the costs of wildlife management and resource conservation.

6. Significance of National Historic Parks and Sites

In addition to the major National Parks, Canada has established a number of National Historic Parks and Sites. These have grown in number from ten in 1955, to 22 in 1960, and the entrants from 323,588 in the earlier year to 885,643 in 1960. Thus, in five years the number of sites increased 120 per cent and the visitors 173.7 per cent.

With close to 900,000 entrants in 1960 there is a strong indication of growing interest in the history and heritage of Canada and, except for a few locations such as the Alexander Graham Bell Museum, the sites have had a definite link with terrain and resources. About 15 of them were forts or settlements located at strategic points. A few still are off the busy highways and outside growing cities but others are precariously hanging on to a limited acreage in the midst of spreading suburbs.

Some of these sites are in need of renovation but there is no doubt that all of them play a significant role in Canada's recreational picture and exert an in-

fluence on resource planning that is almost certain to grow stronger as time goes by. The very knowledge that the number of these sites has more than doubled in five years is an indication of the importance they have assumed. This importance is not based on conjecture. The Travel Bureau surveys in 1959 and 1960 revealed that American tourists were interested enough in Canadian historic sites to rate them second choice in activities during their visits.

There is little doubt that the provinces, too, are viewing this trend with renewed interest. Some, like Ontario, have rehabilitated (in part with Federal aid) such historic spots as Old Fort Henry, and on their own, have established bodies like the Ontario-St.Lawrence Development Commission which has, as its core of development, the Crysler Farm Battlefield, a 2,000-acre park for recreation plus Upper Canada Village. Americans and Canadians alike are waiting for opening day. This Commission also is constructing a series of other parks along the St.Lawrence River to reserve the scenic spots for recreation.

There is little doubt that these endeavors will provide bodies in other areas of Canada with incentives to complete similar projects. The time for long-range planning, however, is the present, and before the opportunities of today become the errors of history.

7. The Need for Public Tourist Facilities

The importance of providing highways, parks, picnic and camping facilities for the tourist is evident whether for the foreign visitor or the Canadian. However, the fact that so high a proportion of the tourists are Canadians with varying motivational and income characteristics is a factor which should influence considerations related to the volume and type of facilities required.

Vacation travel must be given sufficient consideration when planning the location, designing and development of highways because about 95 per cent of the Canadian and American vacationers travel by car. Hence, as the highway provides the most significant means of access to natural areas, there is a growing need for road programs in each province to make new areas more accessible from across the Border and from large Canadian urban centres.

The provision of roadside picnic and camping sites for travelers should be considered an integral part of today's highway development, at least along all major roads. It must be remembered that origin and destination are only two of the three vital components to be considered in planning highways, for much of the enjoyment of any trip is associated with traveling itself.

The rapid growth in use of provincial campgrounds and picnic sites has been illustrated, and this is underlined by a comment from one Prince Edward Island official in August, 1960 ... "We are building some new campsites and picnic areas, and they are being used before we are able to complete them".[17]

Emerging from the foregoing material, then, there appears an undeniable link between tourism and natural resources in various forms. These may range from the sedentary pleasures of a scenic drive to the robust activity of a big-game hunt. At either end of the scale and in between, the enjoyment has its foundation resting on natural resources.

A generation ago there was not the pressure on resource planning to provide the amenities that are expected today. And, if the past and present can be used as guides for the future, the urgency of preparing for even greater demands cannot be contained much longer. What were the dreams of yesterday and the hopes of today must become the actualities of tomorrow. To plan wisely for the future, then, it is necessary to look for the shortcomings of today.

Throughout this paper attention has been focused on the tremendous increase in the use of Canada's natural areas by citizens and visitors. The first consideration, therefore, must be to acknowledge that there are no signs of abatement in this trend and that more facilities will be needed. Secondly, the existing sites must be acceptable and accessible to the public which, if it is thwarted from using available areas, is mobile enough to find other regions that may not lie in Canada. Thirdly, the existing sites and those planned must be in accord with current modes and wants. Physical amenities, attractive areas, tidiness, and increased space all form part of current demand for natural-resource areas.

8. The Need for Statistical Research

The strong ties linking the tourist industry to Canada's natural resources have been pointed out. But it is apparent there are insufficient data to permit a comprehensive understanding of the industry's present resource needs or to allow for realistic planning to keep ahead of its accelerating demands. It is doubtful if any other industry of similar magnitude in Canada has been given such scant attention by economists and statisticians. There is, therefore, a definite need for intensive research to fill several gaping holes in current statistical studies.

The most pressing problem in this area is to undertake a national survey of domestic travel. From the isolated and unrelated data quoted in this paper it

would seem that Canadians comprise somewhere between 80 and 93 per cent of the traveling public along the highways and in public parks in certain areas. Whether these figures hold true for all of Canada is a question that only a thorough survey could determine. Not only would such a study reveal routes of travel and points of tourist concentration, it would, as well, reveal the seasonal flow and changing trends in resource use if conducted over a number of years.

The result of such a thorough study might well indicate many things that could be done to develop natural and other resources across Canada to encourage Canadians to travel in Canada more, and thus reduce the growing deficit on travel account.

This research would also reveal the economic importance to the nation when domestic travel spending is spread from urban areas into more remote regions that are often economically depressed. If the studies revealed practical methods of increasing the flow of traffic into such regions there would be a noticeable benefit to the social and economic health of the nation. At present many regions of Canada seem unaware that retaining the travel spending of local people and attracting other Canadians into the area are just as financially rewarding as garnering American dollars, and are often much less difficult to accomplish.

The next most urgently needed study is to expand existing data on American travel behavior in Canada. While compilations by the Dominion Bureau of Statistics reveal some useful characteristics that lie beyond the more important tabulations of total visitors and dollar spending, it is natural that the effect of travelers on such things as resource use cannot be part of those reports. The surveys performed by the Travel Bureau, too, are not particularly useful in such a study as they are designed for motivational research to assist the travel promotion undertaken by the Bureau.

It was observed from the Ontario research and other provincial data, as well as in the National Parks statistics, that Americans constituted relatively low percentages of the total travelers in different areas of Canada but little is known yet about the pressures exerted on natural resources by these people, and whether their penetration into more remote areas is increasing or not. Thus, useful data for comprehensive studies are not gathered by any central agency nor can the isolated regional studies be built into a composite picture.

There is a distinct need to show a greater monetary link between travel and resource development through research so that all levels of government can appreciate how the tourist contributes in large measure to tax revenues from which resources are enhanced. Earlier in this paper it was shown that hunters and fishermen paid $9.5 million to the provinces in 1959 for licences. There are even larger contributions made by tourists to provincial treasuries. As one example, it has been estimated by the Travel Bureau that American motorists alone, in 1959, contributed a minimum of $12 million in gasoline taxes to the provincial governments. A variety of other federal and provincial imposts, paid by foreign visitors, are an integral part of the cost of many goods and services used, and these revenues filter into the public purse at all levels of government. These sums of tax income derived from tourists can be regarded, logically, as direct offsets to the cost of developing resources for the use of tourists.

A third study that warrants consideration concerns the demands made by tourists on natural resources less remote than wilderness areas which have a habit of becoming linked with tourism in the public mind. When 30 million visitors cross Canada's frontiers annually they bring appetites which have an extensive impact on the agricultural industry and on those who purvey food. This demand for consumables contributes handsomely to the wealth of Canada's farmers and ranchers who, in turn, make extensive use of Canada's resources in their businesses. The extent to which tourism affects the national economy and national resources through these demands, is worthy of greater study.

Research into resource use should not stop at the top levels of government. There is reason to believe that many urban areas in Canada do not contain sufficient park lands for the present population let alone the future necessities. Civic and municipal authorities should be encouraged to examine present resource areas and facilities, and to make adequate provisions for the future. Without such foresight many areas will, no doubt, face the future necessity of purchasing land for recreation that presently is allocated to other uses.

In all of the proposed research there is an underlying need for government – in the broadest application of the term – to recognize its role as guardian of the people's resource-domain. The public has pointed the way by demonstrating its intense interest in natural resources through using them in ascending numbers each year. There remains the necessity of discovering, for government, the missing facts that can make planning for the future so much easier.

93452–64

Notes and References

[1] D.B.S. *Travel Between Canada and Other Countries, 1958,* gives the following reasons for United States motor travel to Canada: Business, 7.6 per cent; recreation, 67.6 per cent; visiting relatives or friends, 22.9 per cent; other 1.9 per cent. Canadians visited the United States for the following reasons: Business, 8.8 per cent; shopping, 9.4 per cent; recreation, 43.4 per cent; visiting friends or relatives, 33.3 per cent; health 2.2 per cent; other 2.9 per cent. (Statements 15 and 23).

[2] Actually the multiplier effect of tourist expenditures varies with the region involved. In areas where goods and services purchased by the tourist are largely produced locally the multiplier effect is much greater than where much more is imported. Generalizations about the multiplier effect of tourist expenditures must, therefore, be used with caution and are not capable of immediate application to any area under consideration. It may be also noted that tourist expenditures in Canada by Canadians outside their home area involve a shift in economic activity from one region or community to another. Unless travel to these areas increases total spending, or the multiplier effect is greater than on the home area, there is no overall economic stimulation from a national standpoint. In the case of the foreign tourist there is a net stimulation from which must be deducted the Canadian tourist expenditures in the United States. These presently exceed American expenditures in Canada.

[3] The lack of data on domestic travel spending will be obvious throughout this report and pertinent recommendations are made in the concluding section.

[4] There are interesting social and economic aspects to this pattern. While the net contributions of tourist expenditures by Canadians may not be as great in terms of the over-all national economy as those of Americans (see previous footnote), it may be a desirable policy objective to *spread* the over-all effects of increased income and expenditure from urban communities to rural communities, especially where the latter have a limited resource base apart from recreation resources. This is especially so when the benefitting communities are *depressed* areas.

[5] No comprehensive survey of interprovincial or intraprovincial travel has ever been performed in Canada and it is necessary to examine the isolated research that has been done by various bodies to gain some insight into this aspect.

[6] Johnson, Irene E. *Tourist Survey,* Nova Scotia. 1960.

[7] From correspondence with the Department of Mines and Resources. January 1961.

[8] *Traffic Count,* Saskatchewan Provincial Parks. 1959.

[9] It should be noted however that the number of American visitors in 1959-60 was 200,000 or 31 per cent more than in 1954-55.

[10] The attached graph confirms this by showing the incidence of miles resident from the border of 17,700 Americans who responded to the 1959 Travel Bureau survey after visiting Canada.

[11] It might be noted that New Brunswick presents an interesting example of a province that does not retain a large proportion of the tourist traffic entering its borders. About 65 per cent is destined for other provinces with Nova Scotia capturing about 36.5 per cent. This may indicate a situation where the development of attractions — natural and man-made — may *hold* the tourist for a longer period in New Brunswick and eventually attract him to New Brunswick for the Province's own interesting features

[12] California Public Outdoor Recreation Plan Committee *Report.* 1960.

[13] Romney, Henry, "A New and Human Science", in *Sports Illustrated.* March 28, 1960. p. 75

[14] Baker, W.M., *A Report on Outdoor Recreation in Southern Saskatchewan* Part 1, Chapter 1, p. 54 ff. Saskatchewan Department of Natural Resources. November 1958.

[15] Taylor, G. D. and R. Y. Edwards, "A Survey of Summer Visitors to Wells Gray Park, British Columbia". *The Forestry Chronicle,* Volume 36, No. 4. December 1960.

[16] *Annual Report,* Secretary of the Interior, U.S. Government. 1959. p. 402.

[17] Correspondence, Prince Edward Island Department of Industry and Natural Resources. August 29, 1960.

Bibliography

Dominion Bureau of Statistics. *Travel Between Canada and Other Countries.* 1959.

Dominion Bureau of Statistics. *Travel Between Canada and Other Countries,* 1958.

Canadian Government Travel Bureau. *Travel Survey, 1959.*

Baker, W.M. *A Report on Outdoor Recreation in Southern Saskatchewan, 1958,* Saskatchewan. 1958.

Clawson, Marion. *Statistics on Outdoor Recreation,* Resources for the Future, Inc., Washington, D.C. April 1958.

Report, California Public Outdoor Recreation Plan Committee. 1960.

Conserving Canada's Resources, A collection of monthly newsletters, Royal Bank of Canada, Montreal. October 1958.

Report on the Bracebridge Survey 1959, Ontario Department of Travel and Publicity. Toronto.

Johnson, Irene E. *Tourist Survey, Nova Scotia, 1960.* Department of Trade and Industry, Nova Scotia.

Annual Reports, *Angling and Hunting Licences Issued in Canada,* 1954 to 1959.

Prince Edward Island Travel Bureau. *Guest Enquiry Survey,* 1960. *Comparative Statements of Visitors to National Parks and National Historic Parks and Sites, 1954 – 1960,* Department of Northern Affairs and National Resources. Ottawa.

Traffic Count, 1959, Saskatchewan Provincial Parks. Department of Industry and Information, Regina, Saskatchewan.

93452—64½

Assessing and Allocating Renewable Resources for Recreation

W.M. Baker,
Recreation Consultant,
Hunting Technical and Exploration Services Limited,
Toronto, Ontario.
(Research Co-ordinator – Recreation – "Resources for Tomorrow" Conference).

The recreation potential of the renewable resource base of Canada is immense and the national man-space ratio – 136 acres per capita – seems quite favorable. However, general approximations are deceptive. Emerging shortages in the populated areas and natural limitations of various types indicate a need for a more cautious appraisal.

Over 80 per cent of the area is associated with the northern barrens and non-productive forest belt. Accessibility is poor and natural limitations are severe. The productive forest belt, which is moderately accessible, provides about 34 acres per capita but ratios have declined by 42 per cent in the last 30 years. The highly accessible space, which is associated with the agricultural belt, contains about 7.5 acres per capita with Ontario and Quebec as low as 3.2 and 3.0 acres respectively. In five counties in the Toronto-Hamilton region the ratio is 1.0 acre or less. Possibly as little as five per cent of this region has the natural capabilities required for large scale multi-purpose urban, regional and provincial parks.

National and provincial parks total 59,720 square miles or 1.5 per cent of the area of Canada. This provides about 2.1 acres of park land per capita. None of the provinces east of Saskatchewan, except Prince Edward Island, supplies official figures on municipal park acreages. However, the national acreage may be estimated at about 275,000.

Growth in the national and provincial park systems has been generally sporadic. About 30 per cent of the area was reserved as early as 1910 and 95 per cent by 1941. Since 1950 provincial parks have increased by 240 per cent in number but by only five per cent in area. Manitoba, New Brunswick and Prince Edward Island still have no lands officially designated as provincial parks although they do provide some camping, picnicking and recreation facilities.

Many provincial parks are more in the nature of roadside picnic and camping sites or small regional parks. About 15 per cent of those examined in this study were 15 acres or less, 14 per cent 16 to 50 acres and 42 per cent 51 to 500 acres. Only 11 per cent were 5,000 acres or more in extent.

Serious distributional limitations are present in the national system. Wood Buffalo Park in Northern Alberta and Northwest Territories contains 59 per cent of the total area. The central provinces, which have 63 per cent of the population of Canada, have less than one per cent of the park area and all of this is in Ontario. Most provincial systems display similar handicaps. For example, southern Ontario has only 5 per cent of the park area but 90 per cent of the population of the province.

It has not been difficult to reserve large parks in isolated Crown lands since little or no cost was involved and the choice between alternative uses was usually limited. In the densely populated areas, where substantial public investment was required for land acquisition, and difficult decisions were necessary between alternative uses competing for scarce land and water resources, public park development has lagged.

Wilderness Areas, which were first established in Alberta and Ontario in 1959, total 7,608 square miles. Additional areas may soon be created in other provinces. There is still a need for geological, botanical and biological nature reserves in the settled sections of the country.

There are about 625 provincial road-side camp and picnic grounds and many municipal and private organizations provide facilities of this type. Recent federal financial assistance in connection with the Trans-Canada Highway and Winter Works Programs has resulted in marked expansion and improvement in these developments.

Historic sites are a unique resource and now occupy a significant position in the pattern of leisure time facilities. Both the federal and provincial governments are active in the historic sites, buildings and marker program. Municipalities and private organizations have also undertaken considerable work in this field. Some archaeological research has been carried out.

Bird sanctuaries, game preserves and forest reserves cover about 1,087,000 square miles or 30 per cent of the area of Canada. While these forms of land use are related to recreation, variations in the pattern of land ownership and management necessitate that they be considered with caution in any evaluation of the allocation of the resource base for public recreation.

The lack of adequate research in the pattern and problems of recreation land use constitutes one of the most serious bottlenecks to the orderly expansion of public recreation facilities and the efficient development of our renewable resources. Basic research is required in the relationship of natural environmental factors such as location, climate, topography, etc. to various forms of recreation. Present recreation land use inventories encompassing both public and private forms of recreation development are a necessity. Finally, a recreation land use capability inventory must be undertaken. These three distinct but closely related lines of investigation will provide the data required for effective recreation planning and development. The research program should be a co-operative effort involving all levels of government with some guiding and co-ordinating agency at the national and provincial levels.

The immense area of Canada fosters an illusion of unlimited space for recreation that is deceptive and bears closer examination. With a population of about 18,041,000 and a total area of 3,851,809 square miles, about 291,571 square miles of which is fresh-water, the national space per capita is about 0.21 square miles or 134 acres. Unquestionably the total recreation potential of this area is enormous and it is little wonder that we have come to regard it as almost a *limitless expanse* of opportunity. However, when the situation is approached in terms of *effective space*, in which the accessibility of area to population is considered and allowances are made for variations in the quality of the resources, substantial modifications are necessary in the space per capita ratio. The application of an historic perspective to the problem provides further evidence for a degree of caution.

Over 80 per cent of the area is comprised of the northern barrens and the non-productive forest belt and can be classed as *poorly accessible* with reference to the distribution of population and the pattern of recreation travel in Canada. Climatic conditions seriously restrict or preclude many recreational activities. While this region meets the requirements of those desiring sport and wilderness adventure, the carrying capacity of the biological environment will not sustain intensive pressures of use per unit area.

The productive forest belt of Canada, which lies north of the agricultural area, can be classed as *moderately accessible* from a national standpoint. It constitutes highly accessible space for the northern urban communities and for a large proportion of the populations of such provinces as Newfoundland and Nova Scotia. This region occupies a critical position in the total pattern of resource use for recreation. Many consider it to be the *ideal vacation land,* and it is frequently regarded as a type of *escape hatch* from possible recreation resource shortages arising out of increasing population densities and past errors of judgment in land development and management.

On a national basis the *moderately accessible* productive forest belt now contains about 34.0 acres per capita. In 1931 the ratio was about 59.2 acres. This is a decrease of 42 per cent in the last 30 years. There is considerable variation between provinces in the space per capita ratio: Newfoundland has 41.8 acres, Ontario 17.5 acres, Saskatchewan 27.9 acres.

There is a wide range in the quality of the resources of this area for various forms of outdoor recreation. Area per capita in terms of *effective space* is undoubtedly far below the above figures. A recent survey of 94,000 square miles of this forest belt in northwest of Saskatchewan, in which there were four large lakes in the Churchill drainage system, (Ile à la Croix, Churchill, Big Peter Pond and Little Peter Pond) with an area of 574 square miles and a shore line of 566 miles, revealed some disturbing evidence in this respect.[1] About 75 to 80 per cent of the shores were lined with rough boulders, and steep banks 25 to 50 feet in height were a common occurrence. Swamp and muskeg fronted another 10 per cent. Only three large sand beaches offering safe anchorage and underwater slopes, extensive level building land and attractive forest cover were present. Only one of the three was readily accessible to the new highway constructed through the area to Buffalo Narrows. In effect only .3 per cent of the shore line provided the physical features required for an organizational centre for a provincial park.

There is some evidence that the productive forest belt may not be able to sustain a very heavy pressure

of recreation use without serious deterioration in those natural qualities of the resource base which currently make it so attractive to the vacationer. While the area now offers an ideal setting for recreation, it is a less productive biological and botanical environment than the more southerly sections of Canada. Land best adapted to agriculture in terms of climate and soils is perhaps also best adapted to fish, game and vegetative production from the standpoint of its ability to maintain volume and quality under intensive use. Land per capita ratios of 10 or 15 acres could be indicative of the advent of problems of over-exploitation in this region. Large public park reservations are probably necessary to reduce use pressures per unit area. Possibly a rotational procedure will be required for some facilities in order to provide a rest period in which the landscape may recover from the effects of intensive use.[2]

The improved and unimproved agricultural lands can be considered as *highly accessible* recreation space since they are associated with the populated sections of the country and road and highway networks penetrate most of them. Here the land per capita is about 9.5 acres, but there are great regional variations: Alberta 34.6 acres, British Columbia 27.5 acres, Saskatchewan 68.8 acres, Ontario 3.2 acres, Quebec 3.0 acres. Ratios in the Atlantic region are quite low, (Newfoundland 1.5 acres, Nova Scotia 3.7 acres, Prince Edward Island 10.1 acres, New Brunswick 4.8 acres). However, in all these provinces except Prince Edward Island, agricultural lands frequently display a *tongue and pocket* distribution which places forests fairly close to populated centres. In five counties in the Toronto-Hamilton urban region the ratio is 1.0 acre or less. Similar densities are encountered in the Montreal region.

The decrease in the per capita of highly accessible area in the last 60 years is indicative of mounting pressures. In 1901 the Canadian average stood at 34.9 acres which is roughly equal to that we now have in the productive forest belt. In Ontario the ratio has dropped from 20.1 acres in 1901 to 3.2 in 1961.

Obviously, reductions in space per capita in this area in consideration of qualitative limitations in the resources are extremely important. Unfortunately they are necessary. Only 11 per cent of this area is wooded and a large proportion lacks water resources. Possibly as little as five per cent possesses the natural qualities necessary for large scale multi-purpose urban, regional and provincial parks. Much of the naturally suitable land is now used for private recreation or urban-industrial development.

1. The General Pattern of Resource Allocation for Public Recreation.

A large proportion of the land and water mass of Canada has been allocated to various forms of public and private recreation. Several hundred million dollars have been invested in buildings and improvements. In spite of this, factual knowledge of the pattern of present recreation land use in Canada is surprisingly limited.

Some information is available with regard to the area of public parks and recreation developments but this is by no means complete. Very little data have been assembled that are suitable for a qualitative assessment of public facilities, apart from evaluations that can be made with respect to historical evolution and distributional relationships to resident populations. Knowledge of the extent and nature of private development is extremely fragmentary.

(a) *The Socio-Economic Dimensions of Resource Allocation for Recreation.*

If public parks are considered to be a necessity, we might well ask why social investment in facilities of this type has been so inadequate? Is there a basic unawareness of the problem or does the difficulty arise from an inability to give an effective expression of the need within the socio-economic system? Is there a feeling that recreation requirements have a low priority in the total gamut of social investment where schools, sewage works, highways, etc., are making such heavy demands? Do we feel that we can provide for our needs by individual rather than group action? Have we been deluded by large public park acreage statistics created through carving immense *paper-parks* out of the isolated wilderness? Undoubtedly all these factors have combined in some degree to produce the present situation.

Possibly the concept of the "Limitless Expanse of the Canadian Frontier" has tended to dull appreciation of park needs. Canada obviously possesses thousands of square miles of sparsely populated forest land. As long as the rural landscape remained open and available for recreation it was difficult for many to become concerned about the park problem – particularly when there were many pressing financial demands for schools, highways, power, etc. The tremendous park acreage that has been accumulated in many provinces over the years obviously tends to allay fears. Few are concerned about problems associated with distributional deficiencies in the systems.

There is a feeling in many quarters that outdoor recreation needs can be met on a private basis. The growth of private cottages and camps bears apt testimony to the attempt that Canadians have made in this direction. While there is undoubtedly a role

for private recreation land use it cannot hope to replace the need for public parks.

In a democratic society social investment is a function of political action and needs are ultimately expressed by the power of the ballot box. While it is true that political leadership has not played the role that it should have in the past in alerting people to the real nature of the park problem, it is equally true that public expression of its requirements has frequently been less than adequate to urge the politicians along. Parks have never become a burning issue in some of the major opinion forming organizations of Canada such as trade union and political groups, television forums, etc. In a democratic society it is vital that the political dimensions of any problem be adequately considered.

Unquestionably there has been a marked improvement in the situation in recent years. Public awareness of the problem is growing and the political process is beginning to stir; quite effectively in some sections of the country and much less so in others. However, there is room for considerable improvement in the general situation and this is undoubtedly one of the most important contributions to be made by the public park associations across Canada.

The real problem of park development arises in the more densely populated areas where many alternative uses are competing for scarce land and water resources. Here substantial public investment is necessary and some difficult decisions must be made between alternative use possibilities. Leaving aside the problems of setting priorities for public expenditures, and assuming that funds are available for public park development, we still face the problem of determining priorities in the allocation of land for alternative uses. Remembering that the range of choice in the use of resources is basically conditioned by differences in their natural qualities, there are certain economic factors and forces that must be recognized in any consideration of this problem.

The relationship between resource uses can be categorized as *competitive* and *complementary*. In the case *where uses are competitive* one may preclude the others. The use of an area for industry, or of a shore line for commercial harbor installations, precludes its use for recreation. In the case *where a complementary relationship exists one* form of land use is tolerant to another or they may even be mutually reinforcing. For example, farmlands support wildlife populations and can be used for hunting. The St. Lawrence Seaway Development provides an illustration of a physical works project that has not only provided opportunities for outdoor recreation but also displays mutually reinforcing relationships in that the power developments and navigation pattern are a great attraction for visitors.

It should be noted that the exploitation of the advantages of complementarity necessitates adequate planning. Moreover with proper planning controls the undesirable effects of many forms of land use on the atmosphere and the landscape may be reduced to a point of tolerance for some form of recreation. In effect, a complementary relationship may be obtained through appropriate land use controls. In the British Isles the entire national park system has been built on the concept of complementarity embodied in multiple-land use.[3]

Uses which appear to be antagonistic to recreation may in fact have complementary aspects that can be advantageously exploited at moderate cost. Mining operations are favorite grounds for rock and mineral collectors and can provide leisure time outlets for amateur and professional geologists. Effort should be made to exploit these possibilities by providing tours, observation platforms and rock piles for the collectors as is done in some operations at the present time. Many other forms of industrial use have leisure time aspects that can be developed to advantage. Finally, the landscaping efforts associated with urban industrial developments can be exceedingly attractive and lend a parklike atmosphere to a community. The outdoor recreation facilities that are sometimes associated with these developments can be integrated into an over-all community recreation program. School grounds offer another example of opportunities for integrated use.

The allocation of resources for recreation may take place within the framework of the aforementioned concepts by private decision expressed in the *market place* or by social action expressed through political institutions. The creation of public facilities may involve the reservation of lands and waters in public ownership or it may necessitate the acquisition of privately owned resources.

Private action to marshal resources for recreation uses such as cottages, camps, golf courses, etc., has shown an ability to compete successfully in the open market with non-recreation resource uses. The rapid rate of cottage development, institutional camps, and various commercial developments clearly indicates its immense competitive strength.

Social action to reserve public lands for recreation seems to be fairly successful when the reservation of Crown lands in remote areas is involved. Where alternative uses are possible and the competitive element somewhat stronger, some difficulties have been encountered. It has frequently been a simple matter to carve out large *paper parks* in isolated areas of *moose pasture* since there was little or no cost involved for land acquisition and society was not faced with difficult alternative choices. While it is essential to reserve parklands of this type, the real test of support for park developments comes

only when the cost of providing access and facilities must be met or a necessity arises to refuse the admission of some non-conforming antagonistic use. The lack of access and public facilities in many park reservations, and the difficulties sometimes encountered in preventing destructive non-conforming uses suggest that enthusiasm for the park concept leaves something to be desired.

Park development have lagged behind growing requirements in the densely populated areas where expensive land acquisition is involved. Actually when the land acquisition program is viewed in broad terms which embrace the full range of complementary uses and external benefits, costs appear reasonable, relative to social benefits.

(b) A General Evaluation of Federal and Provincial Public Recreation Developments.

The six forms of public recreational land use listed in Table I include the major outdoor recreation facilities provided by the federal and provincial governments. Federal Migratory Bird Sanctuaries, Territorial and Provincial Game Preserves and Provincial Forest Reserves are considered separately. While these three items bear important relationships to outdoor recreation and are sometimes included in statistical compilations of this type, it was felt that they display certain characteristics that necessitate separate consideration.

It will be noted that municipal parks have not been included in the table. There is no central record of this information available for any province east of Saskatchewan with the exception of Prince Edward Island, which has about 43 acres of municipal park land in cities, towns and villages.

In the three most westerly provinces there are about 581,188 acres or 90.9 square miles of municipal park land distributed about as follows:

	City Parks	Town Parks	Village Parks	Rural Parks
			acres	
British Columbia	5,108	92	634	7,636
Alberta	14,000	3,311	-------	10,000
Saskatchewan	3,028	3,232	4,207	7,030

If it were assumed that municipal park lands across Canada bore a relationship to population similar to that in the three westerly provinces, municipal park acreage for the entire country would be estimated at 275,000 acres or about 430 square miles.

(i) *Federal and Provincial Park Lands.*

The heart and core of the public outdoor recreation facilities rests on the public park lands which total 59,920 square miles and include 86 per cent of all area listed in Table 1. National Parks form only five

Table 1. Federal and Provincial Park and Recreation Developments in Canada

		Public Park Lands								Historic Resources			
	Population (1960 D.B.S. Estimates)	National		Provincial		Provincial Wilderness Areas		Provincial Roadside Camp and Picnic Grounds		National Parks and Major Sites		Markers Signs and Cairns	
Province or Territory	"000"	No.	Sq. Mi.	No.	Sq. Mi.	No.	Sq. Mi.	No.	Acres	No.	Acres	Nat. No.	Prov. No.
Newfoundland	466	1	156	4	58	–	–	12	960	1	243	8	–
Prince Edward Island	105	1	7	–	–	–	–	11	240	1	222	6	–
Nova Scotia	728	1	367	11	< 1	–	–	6	790	8	480	82	25
New Brunswick	606	1	79	–	–	–	–	53	650	3	84	62	30
Quebec	5,176	–	–	5	10,121	–	–	-a)	-a)	8	233	97	-a)
Ontario	6,167	3	12	85	4,837	28	6,811	74	325	6	84	172	223
Manitoba	908	1	1,148	–	–	–	–	45	158	2	62	29	70
Saskatchewan	912	1	1,496	15	2,295	–	–	176	1,830	3	101	23	53
Alberta	1,309	4	7,042	37	168	3	2,797	213	852	–	–	34	114
British Columbia	1,628	4	1,671	165	13,163	–	–	–	–	2	13	40	100
Yukon	36	–	–	–	–	–	–	31	125	2	4	1	–
Northwest Territories		1	17,300	–	–	–	–	5	20	–	–	–	–
Total	18,041	18	29,278	322	30,642	31	9,608	626	5,950	36	1,526	574	615

a) No information available.

per cent of the total number but they contain about 49 per cent of the area.

Three Canadian provinces have no areas specifically designated as provincial parks. Prince Edward Island operates only camp and picnic sites. New Brunswick is now considering the designation of 53 camp and picnic grounds, totaling 650 acres, as provincial parks. In Manitoba portions of Whiteshell, Turtle Mountain, Duck Mountain and Cormorant Forest Reserves are developed as park and recreation areas and consideration is now being given to establishing these sections of the reserves as provincial parks.

In Ontario available data relate only to facilities operated by the Department of Lands and Forests and include eight areas totaling 42.2 square miles that will open in 1961 and six totaling 22.16 square miles that are now under development. In this province the St. Lawrence Seaway Development Commission operates 10 parks totaling six square miles in extent. The Niagara Parks Commission has about 5.5 square miles of park land. There are also about 45 parks totaling 5.1 square miles operated by the Conservation Authorities in southern Ontario. The National Capital Commission now owns about 156 square miles of park land, parkways and green belt, among which is Gatineau Park with an area of 86 square miles.

The federal and provincial park systems combined cover about 1.5 per cent of the area of Canada and provide a land per capita ratio of about 2.1 acres. By comparison the federal and state park systems of the United States are about 50,000 square miles in extent and offer about 0.1 acre per capita. However, a much more realistic comparison of conditions would require the inclusion of areas operated by the state and federal forest services and county and local governments since those lands now play an important role in the outdoor recreation pattern of continental United States. On this basis the total area in the U.S.A. is 374,748 square miles or about 1.4 acres per capita.[4]

Possibly the Canadian position is really not much superior to that of the U.S.A. where there has been such great alarm over the problem in recent years. Canadian strength may lie in opportunities for substantial expansion of public recreation lands. However, this point should not be overrated too far because in the more densely settled sections of Canada where parks are urgently required, suitable areas are probably as scarce as in the United States.

(ii) *Wilderness Areas.*

Wilderness areas total 9,608 square miles and form about 16 per cent of the total area listed. These developments are a recent form of recreation land use, having been first established in Alberta and Ontario in 1959. It is likely that there will be a marked increase in developments of this type in the next few years. Saskatchewan is considering the establishment of a wilderness area in the Big Muddy Valley in the southern part of the province. Newfoundland is planning the establishment of two such areas in the central portion of the Avalon Peninsula and the south central part of the island. Both will be designed to assist the caribou population which is now in decline.

It is interesting to note that the wilderness areas of Ontario and Alberta greatly exceed the areas in provincial parks. In Ontario, they exceed the area of provincial parks by 40 per cent and in Alberta by 1,500 per cent.

In some respects these wilderness areas are little more than *paper entries.* They can be established on isolated Crown lands and require little or no expenditure for development.

There is no doubt that developments of this type are required, and it is encouraging to note their rapid rate of growth and possible expansion in the near future. However, the establishment of numerous areas of this type with large acreages on remote Crown lands may blind us to the fact that there is a real need for the preservation of geological, botanical and wildlife reserves in the more settled sections of the country.

(iii) *The Roadside Developments.*

Provincial roadside camp and picnic grounds actually occupy a very small proportion of the total resource base devoted to outdoor recreation but they are extremely important in the over-all system. Almost every province has become involved in extensive developments of this type. In Prince Edward Island and New Brunswick they constitute the only *park* facilities provided by the provincial level of government. While no developments of this type are listed for Ontario and British Columbia, it should be noted that many of the smaller provincial parks in these provinces are intended primarily to perform this function.

There has been considerable expansion and improvement in these facilities as a result of federal government assistance to the provinces in recent years in connection with the Trans-Canada Highway and the winter works programs. Eight provinces have joined the Trans-Canada Highway picnic area campground program. Of 106 planned developments 56 have been undertaken. About $670,000 has been spent on a 50–50 share basis between the provinces and the federal government. A similar share arrangement in the winter works program resulted in further substantial expenditures.

In addition to the roadside camp and picnic grounds listed in Table I, many provinces make a practice of locating numerous picnic tables at scattered points

along the highway to serve the needs of the motoring public. Municipalities and private associations frequently provide roadside camp and picnic facilities. The Newfoundland Forest Protection Society offers an example of a private organization that has developed a comprehensive system of roadside facilities along major highways throughout the province.

Roadside developments, particularly those with fairly extensive and elaborate facilities, frequently face serious difficulties when local and regional park developments in an area are inadequate. They sometimes become over-crowded with local residents making use of them for what are essentially local park purposes, so that there is little or no room left for the traveling public for whom they are primarily intended. Almost before the administrative authorities are aware of what is happening a roadside development can assume the use characteristics of a regional or even municipal park – particularly if there are bathing, boat launching and fishing opportunities associated with the site.

(iv) *The Historic Sites and Markers.*

The area devoted to the preservation and development of the historic resources of the country is not large, involving little more than 11 square miles. However, the educational and recreation values derived from these developments are immense. Visits to the major national sites in 1959/60 totaled 641,518. Millions derived benefits from the programs of the provincial governments.

While the Table 1 lists only federally operated historic parks and sites it should be noted that several provinces are now very active in this field.[5] Moreover some provincial parks are highly historic in character.

British Columbia maintains a complete frontier village at Barkerville. In Ontario the Niagara Parks Commission operates Fort Erie, Navy Hall, Fort George McFarland House, William Lyon McKenzie House, Butler Burial Grounds and the site of the Battle of Queenston Heights. The St. Lawrence Development Commission maintains Fort Henry and Upper Canada Village. The Conservation Authorities have a number of historic buildings including Backhouse and O'Hara Mills, Dalziel Barn and Edgeley Pioneer Village outside Toronto. In Quebec the Commission des Monuments et des Sites Historiques ou Artistiques own and operate ten buildings and have classified 40 additional structures as possessing exceptional historic or architectural significance. The classified structures remain in private ownership but may not be destroyed or altered without government permission. When repairs or renovations are necessary the government will pay up to 50 per cent of the cost. Nova Scotia currently operates six historic buildings.

Many provinces are *dabbling* in archeology. Considerable work has been done in Ontario with emphasis on the French Period of occupation. Saskatchewan has undertaken some fairly extensive studies in Plains Archeology. Investigations have been carried out at Mortlach and Boundary Dam near Estevan. A three-year program in co-operation with the federal government is now under way in the area to be flooded by the South Saskatchewan River reservoir.

Historic and archeological sites make little demand on space and yield one of the highest returns per acre invested of any form of recreation land use. This fact should never be forgotten when the reservation of land for this purpose is challenged in terms of alternative use possibilities. Historic resources are a unique commodity resting on a particular association of time and space that offers very limited and frequently absolutely no alternative choice.

Historic buildings can sometimes be moved to an alternative site without too much loss in historic value. There has been a noticeable trend in this direction in recent years, with the establishment of pioneer villages, etc., in which old buildings are grouped together on a site selected for this purpose. However, it should be noted that some structures, particularly forts, have a very close association with the site. When this linkage is broken by removal, or reconstruction on an alternative site, a vital element is destroyed and the whole development can acquire a somewhat trivial artificial atmosphere akin to that of a shallow promotional *gimmick.*

(c) *Bird Sanctuaries, Game Preserves and Forest Reserves.*

These three categories, which are often included in a general inventory of public recreational facilities, undoubtedly play an important role in the total pattern of resource use for recreation in Canada. However, they display such wide variation in land ownership, development, and management, and in their present and future significance for outdoor recreation, that it seems desirable to consider them separately.

About 1,087,00 square miles or 30 per cent of the land and water surface of Canada is included within the area devoted to these uses (Table 2). This is about 38.5 acres per capita.

(i) *Bird Sanctuaries*

There are 100 Federal Migratory Bird Sanctuaries with a total area of 6,530 square miles (Table 3). Only two provinces have lands specifically designated as bird sanctuaries, although all large provincial parks, wilderness areas and game preserves perform this function. Alberta has five areas of this type. Manitoba has 11 game preserves totaling 179 square miles that are primarily bird sanctuaries.

Table 2. Resource Uses Related to Outdoor Recreation in Canada

Province	Migratory Bird Sanctuaries		Provincial Territorial Game Preserves		Provincial Forest Reserves	
	No.	Sq. Mi.	No.	Sq. Mi.	No.	Sq. Mi.
Newfoundland	1	5	–	–	35	2,930
Prince Edward Island	2	3	–	–	–	–
Nova Scotia	5	13	4	–[a]	–	–
New Brunswick	6	10	13	1,130	9	360
Quebec	40	257	9	31,259	–	6,142
Ontario	11	140	70	6,280	6	19,526
Manitoba	–	–	39	6,740	10	5,212
Saskatchewan	15	290	157	12,000	4	120,741
Alberta	7	37	10	–[a]	3	8,935
British Columbia	5	10	35	2,909	63	40,300
Yukon	–	–	2	10,204	–	–
Northwest Territories	8	5,765	6	806,310	–	–
Total	100	6,530	345	876,832	135	204,092

[a] No information available.

Not all the land in the sanctuaries is publicly owned and much of that which is, has not been designated in a manner that would prevent changes in land use that could be detrimental to bird populations.

Table 3. Regional Distribution of Federal Bird Sanctuaries in Canada

Region	Number	Area	Total Area
		(square miles)	(per cent)
Atlantic Provinces	14	31	0.7
Central Provinces	51	397	6.0
Prairie Provinces	22	327	5.0
West Coast	5	10	0.1
Territories	8	5,765	88.2
	100	6,530	100.0

About 88 per cent of the area in this category of land use is situated in the Northwest Territories where eight large sanctuaries exist. Quebec and Saskatchewan are the only provinces in which there is any significant area in federal bird sanctuaries.

(ii) *Game Preserves.*

The 345 game preserves include an enormous area – 876,800 square miles or 24.5 per cent of the land and water mass of Canada. About 93 per cent of the total area is contained in eight very large preserves in the Territories. Approximately 51 per cent of the area of provincial game preserves is in nine large reservations in Quebec and another 20 per cent is in a large number of smaller reservations in Saskatchewan.

Caution must be exercised in evaluating the significance of game preserves for outdoor recreation. The bulk of the area is located far from the main centres of population.

The major areas in the Northwest Territories classified as game preserves are so only by virtue of the fact that hunting privileges are reserved almost exclusively for indigenous populations, whose hunting practices are frequently not compatible with the generally accepted aims and purposes for preserves. Many of the preserves in the provinces are of very limited value from the standpoint of the propagation and protection of game and most of the area is in private ownership. Frequently they have been established primarily to prevent public hunting in ranching, farming and densely settled regions rather than in the interests of game. If the land becomes suitable for some other use a shift may occur with little concern for the effects on game.

In Quebec, game preserves have been developed to some extent for public hunting and fishing. Lodges and other facilities which are rented to the public, have been constructed in several.

(iii) *Forest Reserves.*

Because of a lack of clear definition of the term *Forest Reserve* and the wide variety of management practices in these areas this category must be interpreted with great caution.

The forest management areas of Newfoundland have been included in Table 2 but not the shore line forest reserves. The *timber reserves* of New Brunswick have been listed. The *township forest reserves,* domanial *forests and forest settlements* of Quebec have been taken into consideration. The *northern forest region* of Saskatchewan, which sometimes appears in summaries of this type has been omitted. This results in a considerable decrease of the area sometimes presented for this province.

The significance of these forest reserves for recreation varies tremendously. Those located in areas where public lands are in short supply may eventually assume great importance. In this respect, township, county and conservation authority forest and reforest-

ation areas in southern Ontario may prove to be of more value to recreation in the long haul than many of the vast reserves in other parts of the province. When the provincial reserves are located in remote regions and surrounded by a vast area of Crown land, they are probably of no greater importance than adjacent public lands. Their value to recreation depends primarily on their natural assets rather than on their particular status as forest reserves.

In some instances these reserves are now performing significant recreational functions. As previously noted, those in Manitoba contain extensive public recreation developments and portions of them may soon be designated as provincial parks. Many, such as Timagami Provincial Forest in Ontario, support extensive private cottage developments, fishing lodges, etc., and are fairly heavily utilized for canoeing and camping activities.

A much more detailed evaluation of the significance of the forest reserves in the Canadian pattern of recreational land use is required. Some may actually be of more value than areas now classified as provincial parks. Many may prove to be of no importance whatever.

2. *A Further Analysis of Public Park Development.* National and provincial park lands form about 88 per cent of the total area associated with the outdoor recreational facilities listed in Table 4. A further examination of certain qualitative aspects of these developments is necessary if some of the more significant problems associated with the allocation of resources for these purposes are to be appreciated.

Limited information is available respecting the physical features of the park lands. However there are some data on the growth of the system, the size of individual developments and their distribution in relation to population.

(a) *The Growth of National and Provincial Park Areas.* This discussion is concerned solely with growth of reserved areas. Parks vary greatly in natural recreation potential and in the intensity of their development. Obviously these are factors of importance in an assessment of the total Canadian effort in park development.

Over 99 per cent of the national and provincial park land is included in the accompanying table. The four provincial parks in Newfoundland totaling 58 square miles have all been reserved since 1958.

The national park system of Canada began in 1885 with the reservation of 10 square miles surrounding the hot springs at Banff. For comparison, the federal system in the United States commenced with the formation of Yellowstone Park in 1870. Similar developments began early in Africa. Sabie Game Reserve in the Union of South Africa, which became Kruger National Park in 1925, was set aside in 1898.[5]

Table 4. The Growth of National and Provincial Parks in Canada

	National Parks		British Columbia		Alberta		Saskatchewan		Ontario (a)		Quebec		Total
	No.	sq. mi.	No.	sq. mi.	No.	sq. mi.	No.	sq. mi.	No.	sq. mi.	No.	sq. mi.	sq. mi.
1885	1	2,564.0											2,564.0
86	2	1,028.0											3,592.0
93									1	2,766.0			6,358.0
94									1	8.6			6,366.6
95	1	203.0									2	4,846.0	11,415.6
1907	1	4,200.0											15,615.6
09									1	1,795.0			17,410.6
11			1	828.6									18,239.2
13	1	75.0	1	803.0									19,117.2
14	2	100.3											19,217.5
18	1	6.0	1	0.3									19,223.8
20	1	543.0											19,766.8
21			1	0.2					1	1.0			19,768.0
22	1	17,300.0	2	120.1					1	3.4			37,191.5
25			2	0.3									37,191.8
26			1	0.1									37,191.8

Table 4. The Growth of National and Provincial Parks in Canada (Cont'd)

	National Parks		British Columbia		Alberta		Saskatchewan		Ontario (a)		Quebec		Total
	No.	sq. mi.	No.	sq. mi.	No.	sq. mi.	No.	sq. mi.	No.	sq. mi.	No.	sq. mi.	sq. mi.
27	1	1,496.0	1	966.4									39,654.2
28	1		2	1.9									39,656.1
29	2	1,153.4	1	0.1									40,809.5
30													
31			4	0.2			6	268.9					41,078.6
32					5	4.7	1	34.7					41,118.0
33			2	0.1									41,118.0
34			1	1.2			1	252.0					41,371.2
35					1	1.1							41.392.3
36	1	367.2	1	13.5									41,753.0
37	1	7.0	1	0.6							1	514.0	42,274.6
38			4	3,789.3					1	0.2	1	15.0	46,079.1
39			3	2,033.8			1	1,115.0			1	4,746.0	53,973.9
40			8	40.4	1	0.8							54,015.1
41			3	4,081.1									58,096.2
42			1	0.1									58,096.2
43			1	8.5									58,104.7
44			2	0.6					2	117.0			58,222.3
45			1	0.1									58,222.3
46													
47			2	0.3									58,222.6
48	1	75.6	4	3.3									58,305.4
49			2	0.2	1	6.1							58,311.7
50			2	1.7									58,313.4
51			3	0.3	3	78.4							58,392.1
52			1	0.6									58,392.7
53			1	0.1	3	7.6							58,300.4
54			2	0.1	4	0.9							58,401.4
55			9	6.3	3	36.9							58,444.6
56			38	6.7	2	5.0			34	8.2			58,464.5
57	1	156.0	6	444.8	6	3.6	1	15.5	9	16.3			59,100.7
58			14	1.9	3	12.2			11	45.4			59,160.2
59			23	4.6	2	6.7	1	605.0	16	36.9			59,813.4
60			13	2.0	3	3.5	4	3.8	7	23.7			59,846.4
Total	18	29,278.4	165	13,163.4	37	167.5	15	2,294.9	85	4,821.7	5	10,121.0	59,846.4

(a) Does not include 6 parks totaling 22.2 square miles under development

Park National Albert in the Congo was also established in 1925. The New Zealand park system began in 1894 with the reservation of Tongariro National Park, an area of active volcanoes, forests, glaciers, and a hot crater lake. Sweden, the European leader in this field inaugurated its present system with the establishment of Abisko Park in 1909 (12,300 acres).

Provincial systems were started quite early in the central provinces of Canada. In Ontario, Algonquin Park was established in 1893 (2,766 square miles). In Quebec, Le parc des Laurentides (3,612 square miles) and Le parc du Mont Tremblant (1,234 square miles) were reserved in 1895. British Columbia was also an early entrant with the creation of Strathcona Park (829 square miles) in 1911. The provincial systems of Alberta and Saskatchewan began officially after the transferance of the natural resources from federal control in 1931.

(i) *Growth in the National Park System.*
The acquisition of lands can be divided into four phases on the basis of a particular emphasis upon various parts of Canada.

In the first quarter century from 1885 to 1912 reservations were restricted to the Rocky Mountains of Western Canada. During this period five parks totaling 7,995 square miles were established. These included *Banff* in 1885 (2,564 square miles), *Yoho* in 1886 (507 square miles), *Glacier* in 1886 (521 square miles), *Waterton* in 1895 (203 square miles), *Jasper* in 1907 (4,200 square miles). In total these parks contain 27 per cent of the present acreage of the federal system.

From 1913 to 1918 expansion displayed an interesting diversification. In 1914 Mt. Revelstoke (100 square miles) was added to the Rocky Mountain group. A beginning was made on the prairie component of the system with the creation of Elk Island Park in 1913 (75 square miles). An attempt was made to penetrate southern Ontario with the establishment of the St. Lawrence Islands in 1914 (0.3 square mile) and Point Pelee in 1918 (6.0 square miles). By this time there was little unpatented land along the shore line of the lower Great Lakes. It was necessary to be satisfied with small areas which were really of the size of provincial or regional parks, or enter into an extensive land purchase program.

In the period from 1920 to 1929, about 70 per cent of the present area was established. The major emphasis was placed on the development in the western plains where three large tracts were set aside – Wood Buffalo in 1922 (17,300 square miles), Prince Albert in 1927 (1,496 square miles), Riding Mountain in 1928 (1,148 square miles). Wood Buffalo National Park was largely intended to be, and has remained more of a nature reserve than a national park. This fact must be remembered when assessing the total area of the national system. The park is currently administered by the Northern Administration Branch of the Department of Northern Affairs and National Resources rather than by the National Parks Branch of that department. In this period there was further extension of the Rocky Mountain system with the establishment of Kootenay Park in 1927 (543 square miles). The creation of the Georgian Bay Islands National Park in 1929 (5.4 square miles) represented another attempt to enter Ontario.

From 1936 to 1957 attention was directed toward the Atlantic Provinces. Four parks containing two per cent of the total acreage of the system were established: *Cape Breton,* in 1936 (367.2 square miles), *Prince Edward Island* in 1937 (7.0 square miles), *Fundy* in 1948 (79.5 square miles), *Terra Nova* in 1957 (156.0 square miles).

The national park system began in the Rocky Mountains and a large part of the emphasis has remained there. Excellent natural geological monuments in Western Canada such as the Cypress Hills, and the Badlands of Alberta, were left in provincial control. They could easily have qualified for inclusion on the basis of stated aims and purposes of the federal parks. As early as 1910 it was apparently too late to secure extensive areas on the lower Great Lakes and no development whatever has taken place in Quebec Province. It would seem that the time is appropriate for an extension of the system into the Territories.

(ii) *Growth in the Provincial Systems.*
About 30 per cent of the total area of the provincial systems was reserved as early as 1910. By 1941 about 95 per cent of the present acreage had been secured. Since 1950 provincial parks have increased by over 270 per cent in number but the total area has only grown by about five per cent. The establishment of Meadow Lake Provincial Park in Saskatchewan (605 square miles) in 1959 represents the only sizeable addition during this period.

There has been a steady growth in the park system of British Columbia since its inception in 1911 with the creation of Strathcona Park (530,319 acres). About 57 per cent of the total number of parks have been created since 1954 but they contain only three per cent of the total park area. Over 70 per cent of acreage had been secured by 1941.

Development in Alberta and Saskatchewan was late, being contingent upon the transfer of the natural resources from the federal government to the provinces in 1931. During the period of federal control several areas in Saskatchewan were reserved as forest and grazing lands and later became important provincial parks – Kenosee Lake, Madge Lake and Cypress Hills. Some cottage and public recreation development actually took place in those areas before they were transferred to the provinces.

Saskatchewan has a strong system in terms of area and it compares very favorably with the national park acreages in that province. In Alberta development began in 1932 and was greatly accelerated after 1950, but the total area remains far below that of Saskatchewan. The presence of the tremendous acreage of the national parks in the Rocky Mountains has undoubtedly influenced provincial developments in Alberta.

The growth pattern in Ontario has been sporadic. Development began early with the establishment of Algonquin Park in 1894 (2,766 square miles). With the creation of Quetico Provincial Park (1,795 square miles) in 1909 about 87 per cent of the present park area had been secured.

In the ensuing 46 years, from 1911 to 1955, the addition to park area was quite limited. The bulk of the new acreage was in the northern part of the province. During 15 years, from 1923 to 1937, there was no growth in provincial park area, although the population of the province increased by about 22 per cent. Another 11-year period of inactivity occurred from 1945 to 1955, during which the population increased by about 30 per cent. Most of this population growth was in southern Ontario where there were few provincial parks.

From 1956 to 1960 about 75 parks have been established in Ontario. This represents about 88 per cent of the present number. These parks, however, contain only 2.7 per cent of the total area. During this period about 5.5 square miles of park land were established in southern Ontario by the Conservation Authorities and 6.0 square miles by the St. Lawrence River Development Commission.

In Quebec after the creation of two parks in 1895, no further reservations were made for 42 years. There was a sudden increase in area in the next three years and the present system was entirely secured by 1939.

(b) *Variations in the Size of National and Provincial Parks.*

All national parks can be classified as very extensive in area, with the exception of those in Ontario and that on the north shore of Prince Edward Island. Three of these smaller parks: Point Pelee (6.0 square miles), Georgian Bay Islands (5.4 square miles) and Prince Edward Island (7.0 square miles) are more in the nature of provincial or regional parks from the standpoint of area. The St. Lawrence Islands Park (171.7 acres) is definitely in the latter category.

These smaller national parks are beach and shore line developments in well populated regions and could perhaps be more accurately described as recreation areas. In the 1959-60 season these four parks, with a total area of about 18.4 square miles, received 1,041,682 visitors or 23 per cent of the total attendance at all national parks in Canada. Point Pelee National Park (6 square miles) had 745,280 visitors and was exceeded only by Banff (2,564 square miles) with 980,069 visitors. Obviously, small tracts subjected to such intensive use cannot be considered as natural landscape reserves similar to the larger parks of the system. They are essentially intensive-use shore line recreation areas.

Table 5, which provides a summary of provincial park acreages, includes only 67 per cent of the total area of all parks of this type in Canada. The parks of Quebec, which include 32 per cent of all provincial park areas in Canada, have been omitted but all are large in size. Parc du Mont Orford, the smallest, covers 15 square miles. All provincial parks in Nova Scotia are small as indicated in Table I. Two Mile Lake Provincial Park, the largest, covers only 150 acres. The parks of Newfoundland vary greatly in size, the largest covering about 36 square miles and the smallest about 0.7 square miles.

About 73 per cent of the parks listed have a combined area of less than one per cent of the total. Approximately 16 per cent are only 15 acres or less and another 14 per cent range from 16 to 50 acres. Areas of this size are normally associated with municipal parks, playgrounds and beaches. Another 42 per cent are between 51 and 500 acres, which is perhaps a reasonable size for multi-purpose urban and regional facilities. Parks 5,000 acres or more in extent comprise only 11 per cent of the total number.

In many instances the term provincial park is a misnomer. Many of the so-called provincial parks are really roadside *camping and picnic areas.* With their limited area they can serve no other function. Some might better be termed *regional recreation areas.* Their total acreage and natural attributes could not meet the requirements of a *provincial park* as originally conceived and defined under most existing legislation.

The recent trend toward smaller provincial parks has been the result of a number of circumstances. Many are in the heavily populated sections of the provinces, where acquisition requires land purchase. Because the extension of the provincial systems into these areas has been delayed so long and the competition for space with non-recreation and private recreation has become so intensive, land prices have increased to the point where large tracts are extremely costly. Land must often be purchased by the foot frontage at prices prevailing in summer resort subdivisions.

There is a definite shortage of regional park facilites in the countryside, particularly within a 50 to 100-mile radius of large urban centres. This is one of the most serious deficiencies in the public park systems today. Regional forms of government were lacking in some provinces to undertake developments of this type. In others they failed, for one reason or another, to assume responsibility in this field. In these circumstances, provincial authorities have drifted into the gap or have been prodded into it by local pressures. When basic principles on which provincial parks were founded became confused and the hierarchy of administrative responsibility was vaguely appreciated, it was difficult to resist the expansion of the provincial system into the regional field.

It is felt by the author that regional park development by provincial authorities is not generally a desirable procedure. Technical and financial assistance to regional levels of government seems necessary, but responsibility should be local. Regional park legislation of the type recently enacted by Sas-

Table 5. Area Classification For Selected Provincial Park Systems

Acres	British Columbia				Alberta				Saskatchewan				Ontario				Total			
	Number	Per cent of total number	Total area	Per cent of total area	Number	Per cent of total number	Total area	Per cent of total area	Number	Per cent of total number	Total area	Per cent of total area	Number	Per cent of total number	Total area	Per cent of total area	Number	Per cent of total number	Total area	Per cent of total area
0—5	20		67		1		4						1		5		22	7	76	
6—10	10		81		1		9						2		17		13	4	107	
11—15	11	32	140		—	11	—						5	16	68		16	5	208	
16—25	11		211		2		37		1	7	16		5		103		19	6	367	
26—50	17		635		1		45	1					6		215		24	8	895	
51—100	22	24	1,541		5	17	406						13	23	1,071		40	13	3,018	
101—150	13		1,589		1		130						6		724		20	7	2,443	
151—200	11	15	1,877		5	17	816						4	12	711		20	7	3,404	
201—250	6		1,371		—		—		2	12	488		1		205		9	3	2,064	
251—300	3	15	845	1	1	8	270	1				1	7	15	1,925	2	11	4	3,040	
301—500	16		6,011		2		853		1	7	320		4		1,679		23	8	8,863	1
501—750	4		2,713		2		1,128		1	7	648		4		2,513		11	4	7,002	
751—1,000	3	4	2,509		2	11	1,756	3					3	8	2,322		8	3	6,587	
1,001—1,500	—				3		3,772		1	7	1,280		6		7,289		10	3	12,341	
1,501—2,000	2	1	3,270		2	22	3,922	16					—	13	—		4	1	7,192	
2,001—2,500	—		—		4		8,885						5		11,401		9	3	20,286	
2,501—3,000	1		2,562		1		2,932						—		—		2	1	5,494	
3,001—4,000	1	1	3,520		1	6	3,946	6	1	7	3,776		1	6	3,353		4	1	14,595	
4,001—5,000	—				—								1		4,066		1	1	4,066	
5,001—10,000	2	1	14,141		1	3	6,400	6	1	7	9,920		3		19,490		7	2	49,951	
over 10,000	12	7	8,381,333	99	2	5	71,992	67	7	46	1,452,308	99	6	7	3,353,080	98	27	9	13,258,713	99
Total	165	100	8,424,416	100	37	100	107,303	100	15	100	1,168,756	100	83	100	3,410,237	100	300	100	13,410,712	100

93452—65

katchewan provides a constructive approach to this problem, in that it recognizes the need for assistance but seeks to place responsibility where it belongs in the hierarchy of government administration. Assistance provided to the Conservation Authorities for park development by the province of Ontario serves a similar purpose.

(c) *Distributional Aspects of National and Provincial Park Areas.*

The following analysis is general in character but of sufficient detail to clearly indicate that the distributional pattern of the provincial and federal parks seriously limits on their effectiveness. It provides some factual evidence in support of previous generalizations respecting public action relative to land use competition.

The shortage of recreation land within a 50 to 75 mile radius of the larger urban centres is not discussed in detail. This factor has been illustrated by numerous regional and recreation land use studies. It should be noted, however, that the shortage of regional outdoor recreation facilities represents one of the most serious deficiencies within the over-all *system* of public park lands.

(i) *National Park Distribution.*

The major limitations of the federal system in relation to population are quite obvious from a cursory examination of Table 6. About 59 per cent of the total area is in regions far distant from the settled parts of Canada. Quebec and Ontario, which have 63 per cent of the population of Canada, have less than one per cent of the total area. (There are no national parks in Quebec, as previously noted.)

It is difficult to envisage how this distributional limitation can be overcome. There are no areas suitable for development as national parks in the vicinity of the populated districts of Quebec and Ontario. As noted in the discussion of the historical evolution of the system, it was too late to *get into* this region in the early 1900's without substantial land purchases. Possibly a national park could be established at some point on the shore line of the upper Great Lakes. The present distributional pattern might be improved, both from the standpoint of national and provincial interests, if federal authorities could assume responsibility for some existing provincial park developments.

(ii) *Provincial Park Distribution.*

The Atlantic Provinces are well below the national average for provincial park development. Without the extension acreages reserved in Newfoundland (37,120 acres) the park area for the region would be exceedingly low.

On first examination the statistics for the prairie region are quite encouraging. However, it is the province of Saskatchewan that raises the total acreage of this part of Canada. Manitoba has no areas designated as provincial parks. Alberta, with a population of 1,309,000 or 42 per cent of that of the prairie region, has only 168 square miles of provincial park land.

A large percentage of the area associated with the Saskatchewan system is situated in the northern forest belt and well removed from the populated sections of the province. The expansion of the system in the last two years has attempted to offset this distributional handicap but developments in the southern region involve expensive land purchases. However, the area requirements as *regional parks* have been met and additions are planned for many as funds become available. Extensive parks totaling about 64,000 acres have been planned for the South Saskatchewan Reservoir. This will greatly improve aquatic recreation opportunities in the southwestern part of the province.

Distributional problems in the provincial park system of Ontario are illustrated in Table 8. The South

Table 6. Regional Distribution of National Parks in Canada

Region	Population		National Parks				
	Number ('000)	Per cent of total	No.	Acres ('000)	Per Cent of Total	Acres per 1000 people	Per cent of Total Area of Region
Atlantic Provinces	1,905	11	4	390	2	204	0.29
Central Provinces	11,343	63	3	8	–	–	–
Prairie Provinces	2,129	17	6	6,199	33	1,981	1.27
British Columbia	1,628	9	4	1,069	6	657	0.45
Territories	36	–	1	11,072	59	307,556	1.14
Total	18,041	100	18	18,738	100	10,386	.76

Table 7. Regional Distribution of Provincial Parks in Canada

Region	Population		Provincial Parks					
	('000)	Per cent of Total	No.	Per cent of Total No.	Acres ('000)	Per cent of Total Area	Acres per ('000) pop.	Per cent of Area of Region
Atlantic Provinces	1,905	11	15	5	37	1	0.02	0.02
Central Provinces	11,343	63	90	28	9,573	47	0.8	1.48
Prairie Provinces	2,129	17	52	16	2,463	12	1.1	0.32
British Columbia	1,628	9	165	51	8,424	41	5.2	3.56
Total	18,005	100	322	100	20,497	100	1.1	0.8

Western and South Eastern Administrative Regions of the Department of Lands and Forests lie to the south of a line running roughly from Port Severn on Georgian Bay to Pembroke on the Ottawa River. These two regions contained over 90 per cent of the total population of Ontario in 1956 but only 0.5 per cent of the total park area.

Table 8. Summary of Provincial Park Acreages and Attendance in 1959 by Administrative Regions of Department of Lands and Forests, Ontario

Region	No. Parks	Per cent of No. Parks	Acres ('000)	Per cent of Total Park Area	Visitors in 1959	
					('000)	Per cent of Total
South Western	19	26	11	0.4	1,677	52
South Eastern	13	17	2	0.1	499	15
South Central	11	15	1,769	53.3	609	19
Central	6	8	348	10.2	48	1
Northern	6	8	25	0.8	85	3
Mid West	8	11	5	0.2	80	3
Western	11	15	1,161	35.0	234	7
	74	100	3,321	100	3,232	100

In these southern regions there are about 2.8 acres of provincial park land per 1000 people. Rondeau Provincial Park (established in 1894-5,000 acres) and Pinery Provincial Park (established in 1957-4,250 acres) are the two largest developments in the South Western Region and both are well over 100 miles from the Toronto-Hamilton conurbation. Presqu'ile Provincial Park (established in 1922-900 acres) is the largest in the South Eastern Region and is equally distant from the eastern margins of the aforementioned urban concentration.

The number of visitors to the parks of the various regions clearly indicates the significance of special distribution. About 67 per cent of the total attendance is in the parks of the southern regions although they possess only five per cent of the area.

It is of interest to note that the five square miles of park land operated by the Conservation Authorities received 1,375,000 visitors in 1960. This is about 60 per cent of the total attendance at all provincial parks in the South Western and South Eastern Region and 30 per cent more than enjoyed by the 3,308,000 acres of provincial parks in the northern parts of the province. These small areas had a 295 per cent greater attendance than the 1,760,000 acres of Algonquin Park which is regarded by many as the *Queen of the System,* although supporters of Quetico Park would undoubtedly challenge this exalted title. There is no doubt that the strategic location of the parks of the Conservation Authorities, particularly with respect to Metropolitan Toronto, is the critical factor involved.

Here the expansion of park facilities is at least 15 or 20 years too late. Sizable strategically located parks along the shore line of the Great Lakes were *shut out* as early as 1910 in the absence of substantial land purchases. Land acquisition costs have now become enormous.

The delay in expanding the system into the rural landscape of Ontario was unfortunate. Perhaps the

overemphasis on the northern wilderness as the ideal recreation environment dulled appreciation of the value of the resources of this area for provincial park development. The tremendous expansion of private cottages, summer homes, camps, sporting clubs, etc., throughout the area during this period offered ample evidence to refute any narrow conception of this type. Of course, park development here necessitated land purchase in which there was apparently an unwillingness to indulge at that time.

About 68 per cent of the park acreage (10,121 square miles) in the central provinces is situated in Quebec. About 50 per cent is located a considerable distance from the dense population in the St. Lawrence Lowland. Parc de la Vérendrye, (4,746 square miles) is about 180 miles northwest of Montreal. Le parc de la Gaspésie (514 square miles) is 192 miles northeast of Rivière-du-Loup and 295 miles from Quebec City.

(d) *Criteria for Responsibility in Public Recreation Development.*

While the natural landscape requirements for various public outdoor recreation facilities differ, there are two principles that must be recognized in the development of an adequate public recreation system. These can be termed the *Principles of the Unique and the Representative.* They apply to developments by all levels of government, including municipal, and to all types of public outdoor recreation facilities. Their application to indoor forms of recreation is more or less restricted to the location factor, which is the major determinant in the selection of areas for uses of this type.

In the development of a system of public outdoor recreation facilities, we must utilize resources that possess a *unique combination of natural factors.* If the stated purpose of a park system is the preservation of areas of outstanding natural beauty, only those that possess a unique combination of resources within the area of jurisdiction of the operating agency must be included. The application of this principle to historic sites and nature reserves is obvious. It is equally valid in the development of park systems in urban areas, where there are almost invariably river valley or water front lands that possess a unique combination of resources for park purposes. In the case of tot lots, sports fields and playgrounds uniqueness is largely a matter of location whereas in the larger urban park lands it depends on a combination of location and natural factors.

The Concept of the Representative is of equal importance and only through its proper application is it possible to obtain a balanced system of public outdoor recreation facilities. This principle to a large extent provides a safeguard against problems of maldistribution.

Any country, province or municipality contains a variety of major natural environments all of which are useful for recreation in one form or another. For example, Canada can be divided into a number of natural regions such as the Rocky Mountains, Prairies, Great Lakes Lowlands, Arctic, etc. Each of these regions possesses a particular combination of resources that are capable of providing a particular recreation experience. Similar activities such as fishing, camping and hunting may be enjoyed in all, but fundamental differences in the natural environment provide for a somewhat different emphasis and a particular over-all experience.

The principles of the Unique and the Representative, which are directly related to an appreciation of landscape, must be applied by a comparative process. A knowledge of the resource base and its recreation potential is therefore necessary. In effect they depend on recreation land use capability studies. The fact that such studies are lacking on a scale required for these purposes is possibly a basic cause for the failure to apply these principles in the past.

The subjective nature of any determination of what is unique and representative need not cause undue concern. Obviously there are many ways in which the resource base of Canada, the provinces or the urban municipalities may be classified. There may and will be considerable variation in what is considered unique and representative. However, when all the major characteristics of the resource base are mapped, certain large groupings stand out. There would be little difference of opinion about the major natural regions of Canada. Some argument might arise over boundaries and the minor subdivisions of the regions, but this is not too consequential for the application of the principles to the purposes for which they are intended.

It is obvious that an area suitable for development as a national park in accordance with these principles will possess physical attributes and the unique and representative qualities that are highly suitable for a provincial park. The same situation may exist with respect to the development of an area as a provincial or regional park or as a regional or municipal facility. The solution to this problem obviously lies in an analysis of the resource base as a whole, whereby the real significance of the area can be assessed. If a resource fits the requirements of a park suited to development by a higher authority, it should be developed by it. If it cannot meet these requirements it becomes the responsibility of a junior government. Incidentally, it might be noted that there is some ground for seriously considering a shift in jurisdic-

tional responsibility for some existing park developments in accordance with these principles.

It is recognized that land costs and established patterns of land use may make it difficult to effectively apply the concepts of the unique and the representative in many parts of Canada. However, they provide a frame of reference that may be applied to future development, and a standard with which to test the adequacy of present systems.

It might be noted that these principles are basic to a satisfactory solution of the problem of jurisdictional responsibility between various levels of government. When a government has undertaken to provide park lands, historic sites, nature reserves, etc., and their intended purpose has been defined, the criteria of responsibility for any level of government for any particular development basically depends on reference to the concepts of the unique and representative applied to the area under the jurisdiction of the agencies involved.

3. *Research Requirements for Recreation Land Use.*
Inadequate research in recreation land use represents one of the most serious handicaps to the orderly expansion of public recreation facilities and the efficient development and management of renewable resources in general. Recreation now occupies such an important position in resource use that judgements and decisions must rest on a solid foundation of factual knowledge similar to that available for other forms of land use such as agriculture or forestry.

(a) *The Scope of the Research.*
Research requirements relative to demand are outlined in other papers in the recreation sector. Three distinct but closely related lines of investigation are required immediately for an effective evaluation of supply prospects.

(i) Basic Research in the Relationship of Natural Environment to Recreation
(ii) A Present Recreation Land Use Inventory
(iii) A Recreation Land Use Capability Inventory.

There is a suggestion of a hierarchy of procedure in the items listed. The first two constitute basic research for the third. All three should eventually culminate in the preparation of master plans for recreation land use.

Basic Research involves the study of the relationship of such factors as location, climate, topography, woodland cover, etc., to various forms of recreation land use. An ultimate objective of this research is the determination of optional and limiting conditions for various recreation uses that will serve as criteria for the evaluation of the resource base for recreation.

The natural systematic scientists have a contribution to make to recreation similar to that which they have made to agriculture and forestry. They can bring a broader perspective and deeper understanding to current problems of resource use for recreation, similar to that provided by the land economists in recent years.

The *Present Recreation Land Use Inventory* must include public and private forms of recreation land use. The analysis of public developments contained in this paper obviously requires substantial elaboration. Private developments such as cottages, golf clubs, fishing clubs, etc., have now assumed significant proportions in all provinces and are giving rise to some serious administrative problems such as pollution control, subdivision regulation, survey and plan registration, provision of access roads, etc.

This type of inventory is not a frill or mere academic exercise. Its application to recreation planning and resource management has immense value. It provides fundamental data for the study of environmental relationships in recreation land use and the testing of the capability criteria.

The lack of present recreation land use inventories is in a large part responsible for the previously noted inadequacies in basic research. An inventory would reveal the amount and location of naturally suitable recreation land that remains undeveloped. This information is essential for the preparation of development plans for public facilities. Finally it would provide a basis for a realistic appraisal of the nature and scope of the administrative problems associated with private development.

To achieve such a diversity of objectives careful consideration must be given to the design of the study so that significant differences and similarities in the recreation land use pattern may be revealed. The aims and purposes of the inventory must be clearly defined before operations proceed. This will require consultation with all levels of government. It would probably be advisable to undertake a few pilot studies in various regions of Canada before methodology for a national inventory is finalized.

One important end product of this research would be a present recreation land use classification. There have been numerous attempts to produce classifications of this type, most of which have been based on functional differentiations. The information provided by this suggested inventory should result in the evolution of a much more useful classification for recreation planning and development, since a comprehensive body of data would be available that would permit differentiation of various uses in terms of the degree of public and private policy control, the jurisdictional responsibility, the environmental focus of use, as well as the usual functional division.

A *Recreation Land Use Capability Inventory* would determine the quality, extent and location of the natural resources useful for various forms of recrea-

tion. Considerable original field research would be necessary. Fortunately, the large body of taxonomic and inventorial information accumulated for many natural resources such as forests and soils, etc., may be effectively applied to the problem, once criteria have been established by which it may be evaluated in terms of recreation use. However, the conversion process depends for a large part on fundamental environmental research and present land use studies of the type previously noted. They hold the key to the utilization of a huge public investment in natural resource research.

The diversity of the public and private recreation pattern and the variety of possible recreation uses in any particular area, may present some serious problems for the selection of capability classes and the criteria on which they will be based. Agricultural use capability classifications have evolved to their present stage only after a half century or more of voluminous and detailed research in fundamental and applied sciences and a long period of trial and error with various systems. Recreation studies of this type obviously face a similar period of evolution in the years ahead.

The test for any classification is pragmatic. The capability classification initially devised need take into consideration only those factors that are of major consequence for policy formulation and master planning. Present knowledge of populations and natural phenomena must be supplemented by some additional research, particularly on climate and shore line conditions, as well as by information gained from present recreation land use studies, and experience derived from the operation of existing recreation developments. It should be possible to obtain an end-product of great value within a two to three-year period.

Major Environmental Factors to be Considered in Establishing a Capability Classification for Recreation Land Use

1 Cultural Environmental Factors
- (i) Location in relation to population
- (ii) Historical association.

2 Natural Environmental Factors
- (i) Physiographic pattern
  - (a) Water access and shore line conditions
  - (b) Topographic configuration
  - (c) Drainage conditions.
- (ii) Vegetative Pattern
  - (a) Composition – prairie tall or short – forest conifer mixed, etc.
  - (b) Form – scrub, mature, crown cover rating, etc.
- (iii) Biologic Pattern
  - (a) Bird and animal population
  - (b) Fishing conditions.
- (iv) Climatic Pattern
  - (a) Temperature
  - (b) Winds
  - (c) Precipitation
  - (d) Sunshine fog and cloud cover.

It is a simple matter to list the major environmental factors involved. Establishing fairly precise optional and limiting values for various recreation uses as a basis for assessment of the landscape is a much more difficult task. However, keeping in mind the urgency of the need for information of this type and the initial objectives of these studies, it should be possible to establish useful capability criteria. A high degree of subjectivity will be present in the process and subsequent modifications can be made as research provides additional insight. The magnitude of the task of evolving a recreational land use classification in detail should not discourage a general initial approach that can be of immense value for strategic planning.

(b) *Administrative Requirements.*

A co-ordinated and co-operative effort is required by all levels of government, together with active participation in certain phases by the universities and research councils. Many of these may need to broaden their present sphere of activities. Specialized consulting services can be effectively and economically utilized for many operations.

A central agency is necessary at the national level, charged with the responsibility of survey design, liaison with governments and some research operations. A separate body such as the *Recreation Resources Review Commission* in the United States might be established. Such an organization could be integrated with any body that might be established with similar objectives relative to the entire field of renewable natural resources in Canada. Alternatively the task could be given to the National Parks Branch where it might become a continuing part of their operations. A considerable expansion would be required in the research staff and facilities within the service.

A similar agency is necessary at the provincial level. Here there are several organizational possibilities. A separate body analogous to that at the national level might be created. Park and recreation staffs might assume the function. The special park and recreation co-ordinating and integrating agencies recently established in some provinces, such as Ontario, might constitute the logical vehicle. Different approaches could be adopted by the various provinces and probably should be.

It is considered desirable to utilize the administrative and research staffs of park departments at every level of government in both the design and operation of inventorial operations. Some economies can be effected in this manner. More important, park and recreation personnel have something to contribute to the success of the undertaking and can gain a broader appreciation of the problems facing them through involvement. They are the people who must administer the recommendations and developments springing out of these studies.

Universities and research institutions are the logical choice to undertake much of the fundamental research in recreation land use previously outlined. Special grants could be provided to enable this work to be undertaken but it is essential that the program be co-ordinated by the central provincial and national agencies to determine that effort is generally related to the immediate problems facing recreation land use planning. It is not assumed that research can be completely channelled since significant contributions frequently come from free-ranging research. It is possible however to direct the total body of research towards clearly defined objectives or requirements to great advantage.

The need for a broad approach to the research problem deserves emphasis. Social and physical scientists can make an effective contribution as previously noted. At all levels of government a host of agencies are directly and indirectly concerned with recreation land use. Public health, highways, agricultural departments, etc., can be usefully brought within the orbit of park and recreation planning since their operations affect recreation and are affected by it. The personnel of these departments have special skills to contribute. They face particular problems arising out of recreation land use that must be taken into consideration in the initial design of the inventory studies. To achieve maximum benefits, a broad perspective must be adopted because recreation occupies an increasingly significant position in resource utilization and cuts across the sphere of responsibility of many of the established government administrative structures.

Notes

[1] Baker, W.M. *A Recreation Report on the North-West Part of Saskatchewan with Recommendations for the Establishment of a Provincial Park on the Waterhen River and the Improvement and Development of Facilities in Other Places.* Department of Natural Resources, Regina. December 22, 1956. pp. 186 (restricted mimeo).

[2] Brooks, Lloyd. *"Holding the Line Against Human Erosion". Parks and Recreation Magazine,* Volume 40, No. 4, April, 1956. pp. 9.

[3] Dowler, John. *National Parks in England and Wales.* H.M. Stationery Office Cmd. 6628 May 1945. pp. 97.

[4] Outdoor Recreation Resources Review Commission. *A Progress Report to the President and to the Congress.* U.S. Government Printing Office, Washington, D.C. January 1961. pp. 20.

[5] *The Preliminary Summary of Discussions.Dominion Provincial Conference on Development of Historical Resources,* Toronto. October 17-18, 1960. (restricted mimeo).

[6] Brockman C. Frank, *Recreational Use of World Lands,* McGraw-Hill Book Company, New York. 1959 pp. 259 ff.

Bibliography

Adams, K.A. "Multiple Use on Private Lands", *American Forests.* 62 (8) 14-15 58-59. July 1956.

Anonymous. "Definition of State Parks and Related Areas", *Planning and Civic Comment.* July-September 1935. pp. 18.

Anonymous. "Criteria For State Parks", in *Recreation.* Vol. I, No. 10. October 1958.

American Institute of Park Executives. "Report of Committee on City Planning", *Proceedings of 42nd Annual Convention.* 1948.

Booth, A.W. *The Lake of the Woods North Eastern Inland Empire: A Study of Recreation Sites,* Bulletin No. 5 State College of Washington, School of Economics and Business, Bureau of Economics and Research, Pullman, Washington. 1948.

Brewster, S.F. "Park Appeal", in *Planning and Civic Comment.* October-December 1937.

Brockman, C.F. *Recreational Use of Wild Lands,* McGraw-Hill Book Company, Toronto. 1959.

Butler, George G. "Our Space Standards", *Recreation.* Vol. I. No. 1. January 1958. pp. 24-26.

California Committee on Planning For Recreation Park Areas and Facilities, *Guide for Planning Recreation Parks in California,* California State Printing Office, Sacramento. 1956. pp. 77.

California Senate State Committee. *Recreation State Beaches and Parks,* Fourth Partial Report Senate Interim Committee, California. 1957. pp. 3-64.

Casson, H. "A National Water Park", *Time and Tide.* Vol. 37 No. 44. London. 1956. pp. 1326-27.

Clawson, Marion. *The Role of State Parks in Meeting Recreational Demands of the Future.* Resources For The Future. Mimeo paper to the National Conference on State Parks. Rockland, Maine. September 20, 1960.

Committee on Standards of the National Conference on State Parks. *Planning and Civic Comment.* June 1956. pp. 54-61.

Committee on Standards and Surveys National Forest For Historic Preservation. "Criteria For Evaluating Historic Sites and Buildings". *Planning and Civic Comment.* September 1956. pp. 48.

Cougill, Kenneth R. *Suggested Criteria For Evaluating Areas Proposed for Inclusion in the State Park Systems,* National Conference on State Parks. December 1954. pp. 3-16.

Cox, L.D. "Some Basic Principles of State Park Selection and Design", in *American Planning and Civic Annual.* 1948-49.

Demaray, A.E. "A Relation of the National Park Service to State Parks". *Planning and Civic Comment.* December 1951. pp. 51.

Flick, A.C. and C.C. Adams. *Suggestions for a State Policy in Relation to Historic and Scientific Reservations and A Policy for State Historic and Scientific Reservations,* New York State Museum Bulletin No. 284, New York State University, Albany, New York. 1929.

Glickson, A. "Recreational Land Use", Background Paper No. 46. Werner Green Foundation, International Symposium. *Man's Role in Changing The Face of the Earth.* Princeton, N.J. June 16-22, 1955.

Greeley, A.W. "Proving Grounds For Multiple Use", *American Forests* 63 (10): 24-26 78-83. October 1927.

Harper, R.A. *Recreational Occupance of the Moraine Lake Region of North Eastern Illinois and South Eastern*

Wisconsin, Chicago University Press, Chicago. 1950. pp. 176.

Hines, L.G. "Wilderness Areas: An Extra Market Problem in Resource Allocation", *Land Economics*. Vol. 27. No. 4. November 1951. pp. 306-313.

Lothian, W.F. *A Brief History of National Parks Administration in Canada*. National Parks Service, Ottawa, 1955. (mimeo) 8 pages.

National Recreation Association. *Types of Municipal Recreation*. New York. 1937.

New Hampshire State Planning and Development Commission, *A Study of Lake Winnepesaukee Shoreline*. 1949.

Saner, C.G. "The Order of Parks", *Planning and Civic Comment*. March 1952. pp. 1.

Schwols, F.T. "State Parks and Recreation from the State's Point of View", in *American Planning and Civic Annual*. 1943.

United States National Park Service for the Land Planning Committee of the National Resources Board. *Recreational Use of Land in the United States*, Department of the Interior, Washington, D.C. 1938. pp. 103.

United States National Park Service. *A Report on a Seashore Recreation Area Survey of the Atlantic and Gulf Coasts*, Department of the Interior, Washington, D.C. 1955. pp. 221.

----*Great Lakes Shoreline*, Recreation Area Survey, Department of the Interior, Washington, D.C. 1959.

----*Pacific Coast Recreation Area Survey*, Department of the Interior, Washington, D.C. 1959. pp. 207.

Werth, C.L. "National and State Parks", *Planning and Civic Comment*. December 1955. pp. 1.

Werth, C.L. *Basic Need For Land*. Mimeo address to American Institute of Park Executives, Minneapolis, Minnesota. September 23, 1957.

Wolfe, Roy I. *Recreational Land Use in Ontario*, Ph. D. Thesis, Department of Geography, University of Toronto. 1955.

The Significance of Reservoirs in Recreation

J.A. Boan
Economic Division, Canada
Department of Northern Affairs
and National Resources.

Visits at reservoirs by people seeking outdoor recreation indicate that man-made lakes have a significant value apart from their importance for such primary purposes as power, irrigation and flood control. Their usefulness in expanding the recreational resource base may be more dramatic in arid regions but they nevertheless have an equally important role to play in humid areas. The South Saskatchewan river reservoir will provide facilities for hunting, fishing, swimming, boating, picnicking, camping, and cottages in an area now almost devoid of such facilities. In humid areas reservoirs add to the natural recreational resource base which, over time, may become lost to cottage and industrial developments and destroyed through excessive use.

Considering the many recreational values resulting from the building of a reservoir, it is difficult to understand why these values have so often received insufficient consideration. This may be because recreational values are intangible.

Perhaps reservoir planners have overlooked the growing importance of recreation in an increasingly affluent society. Lack of co-ordination between the many different agencies concerned with the planning of a multi-purpose project may be another cause. It is imperative that all planning work be so co-ordinated as to avoid irreversible mistakes in the planning of structures, acquisition of land, and preparation of shore lines, that would add greatly to the ultimate cost of recreational developments and perhaps make it impossible to reap maximum benefits from these developments.

Two principles emerge. First, recreation should be on a par with other basic purposes in the planning, construction, operation and maintenance of reservoirs. Second, the provision of reservoir recreational facilities should be integrated with regional and national programs for recreation development.

1. *The Recreational Value of Reservoirs*

If the *demand* for water for recreational purposes continues to rise to the end of this century at the same rate as in the last fifteen years, reservoirs will gather increasing importance as an additional recreational resource. They will be needed to help overcome limitations of water supply in arid areas. They will also be needed to enlarge the supply in more humid areas where natural recreational resources for public use have been lost to housing, cottage and industrial developments and where population density is so great that excessive use is destroying existing recreational resources.

A reservoir may possibly exert its greatest impact in arid areas deficient in water-based recreational resources. Indeed, the building of reservoirs, in these areas, may help to *equalize* aquatic recreational opportunities throughout Canada.

The South Saskatchewan River Project affords an example of a multiple-purpose development with unique opportunities for immense recreational benefits. It will provide a reservoir with a shore line almost 500 miles in length along which there will be facilities for hunting, fishing, swimming, boating, picnicking camping, cottages, etc.. It would also permit the stabilization of the lakes, in the Qu'Appelle Valley which now support the core of the recreational development in southern Saskatchewan.

The reservoir can be expected to sustain the fish which are indigenous to the South Saskatchewan river, especially pike, pickerel, and gold-eye and deep cold water pools may permit the introduction of new species such as trout. Improved water conditions in the lakes of the Qu'Appelle chain could improve angling conditions in these areas. In the reservoir area migratory waterfowl should greatly increase. In the irrigation

areas, the pheasant population should find conditions favorable to its propagation, as was the case in the irrigation districts of Alberta and the Dakotas. The tourist trade may also benefit from the project. The project will improve the attractiveness of an area almost devoid of trees, lakes and streams and good park sites. In brief, the reservoir will offer to the people living in the area many pleasures and satisfactions derived from outdoor recreation such as physical and health, esthetic and educational values.[1]

At least two-thirds of the people of Saskatchewan will be within a two-hour auto journey of a large body of water created or improved by this project. For the first time many people will have an opportunity to enjoy outdoor recreation on a grand scale. A recreation consultant has estimated that visits at this reservoir, for all kinds of recreation, will increase from about 269,000 in 1965 to about 467,000 in the year 2000.[2] With sightseeing about the only attraction, the construction site of the South Saskatchewan River Dam had over 82,000 visitors in 1960.

American experience illustrates the popularity of reservoir sites as recreational attractions. As one example, the following figures show the number of visits to reservoirs built by the United States Corps of Engineers in the southwestern States and the extent to which actual visits exceeded estimated attendance.[3]

Reservoir	1946 estimate of future annual visitor-days	1956 annual visitor-days
Dennison (Lake Texoma)	600,000	7,471,600
Canton Dam, Oklahoma	45,000	561,900
Great Salt Plains, Oklahoma	32,000	436,200
Hulah, Oklahoma	18,000	471,700

It is claimed that "the Lake Mead National Recreation Area, encompassing Hoover and Davis Dams and their reservoirs, is second only to the Blue Ridge Parkway in tourist attraction."[4] In its 25 years of existence more than 38 million visitors have come to this recreation area, 3,390,574 of them in 1959.[5]

In fairly humid areas, reservoirs are also needed to expand the natural recreational resources. The popularity of the Ontario-St.Lawrence Development Commission's facilities between Morrisburg and Cornwall is a case in point. These facilities are man-made structures that have to cope with the draw-down problem common to many reservoirs. Nevertheless, the number of visits there rose to 925,000 in 1960, which represents an increase of 20 per cent over 1959. The engineering features of the seaway undoubtedly drew many people to the area. However 9,000 overnight camping groups were accommodated in the park areas which is an indication of the recreational values of the area.[6] In the same year, visits at the Fanshawe Dam of the Thames Valley Conservation Authority just outside London, Ontario, totaled about 160,000.

As time goes by the need for more recreational resources in areas of high population density will become increasingly pronounced. Reservoirs offer a possibility of enlarging the recreational resource base of an area and they may also offset the destructive effects of excessive pressure or congestion on natural beaches and parklands. "It is one of the paradoxes of recreation that as increasing numbers of people grow to appreciate nature and seek enjoyment in the outdoors, they tend to destroy the values they came to find. Recreational uses of land are essentially extensive uses. For many people, the ideal man-land ratio in outdoor recreation is represented by the wilderness areas. Yet, an increasing intensity of recreational land uses is unavoidable if recreational opportunities are to be made available to a growing population of users"[7]

If the rate of increases in visits is any criterion, then there is no doubt as to the increasing popularity of reservoirs for recreation. Rates of increases in visits from the end of the last world war to 1958, at reservoirs and other recreational areas in the United States, were as follows:[8]

Recreational Site	Average Annual Percentage Increase
Corps of Engineers Reservoirs	28
T.V.A. Reservoirs	15
National Wildlife Refuges	12
National Forests	10
State Parks	10
National Park System	8
Municipal and Country Parks	4

It has been estimated that the *demand* in the United States for resource based recreation areas of an intermediate type which provide for all-day outings, for boating, fishing, swimming, etc., would increase 16 times in the next 40 years.[9] Since natural areas which can provide the necessary water resources for this type of development are limited, reservoirs will play an increasingly important role.

Because of differences in climate, customs and economic factors, the potential *demand* may increase somewhat less rapidly in Canada than in the United States; but because of the great similarities in the ways people spend their leisure in the two countries, the potential increase in Canada is likely to be of proportional magnitude. The popularity of reservoirs in the United States, the upward trend in water-based recreational activities in Ontario and elsewhere, and prospects for the next 40 years, all suggest that the significance of reservoirs in recreational programs has become so pronounced that it cannot be ignored.[10]

2. Some Problems in the Development of Reservoirs for Recreation

(a) The Need for Recognition of Recreational Values in Reservoirs

Recreational values must be given due consideration in the initial planning of a reservoir project and at each phase of the ensuing development and operational program. Recent park and recreation planning work for the St. Lawrence Seaway and the South Saskatchewan river reservoir point to a growing acceptance of this viewpoint. Still all too frequently recreation is given little or no consideration in the planning of reservoir developments.

The day may yet come when reservoirs are built primarily for recreational purposes. Today, they are built chiefly for other purposes and recreational use is no more than an incidental purpose. If people better understood the importance of recreation in general and of water-based recreation in particular it would be considered as one of the multipurposes for development and not as an incidental benefit. Canada might profit from what has been done in the United States and initiate a continuing study of recreation. This study should follow the same general pattern as the work done by the National Outdoor Recreation Resources Review Commission in the United States,[11] but with broad enough powers to include all forms of outdoor recreation.

Two principles emerge from the permises that a) reservoirs may greatly enlarge the recreational resource base, both in arid and humid regions; b) it is desirable to minimize the destructive effects of a too intensive use of existing recreational areas; c) the cost of developing recreational facilities may be held to a minimum by planning, land acquisition and improvement before flooding. The first principle is that, at the planning stage, recreation should be placed on a par with other basic purposes of a reservoir and that this parity should be preserved through the subsequent stages of construction, operation and maintenance. When this approach is followed the agencies responsible for recreational developments have an opportunity to study the project and make recommendations about land acquisition, engineering requirements and management. The result: a better job at lower cost. The second major principle is that recreational developments should be considered in the general context of recreational programmes within a region.

Recreational values to be gained from reservoir construction are so obvious that it is difficult to understand why recreational uses have so often failed to receive due consideration.

The significance of reservoirs in recreation may very well be overlooked because of a psychological bias rating natural lakes as *good* and fit for recreation, and artificial lakes as too elaborate and lacking in natural or primitive wonder. It is difficult to understand this bias when the popularity of reservoirs is so obvious, particularly when large developments frequently offer to the eye the breathtaking display of some of the finest engineering achievements.

Perhaps the tendency of reservoir planners to treat recreation lightly stems from their failure to recognize its importance in an increasingly *affluent* society.[12] This might be considered as a form of "cultural lag", understandable in view of the many pressing and persistent problems which public figures must contend with. However, it is surely not too much to ask that reservoirs built for other purposes be also developed for recreation. This would go at least some distance toward meeting the prospective potential *demand.*

In a market economy where measurable benefits and costs are the key to decisions, the use of resources for recreational purposes may tend to be overlooked because so many of the benefits of recreation are intangible. True enough, in recent years, an attempt has been made to place an economic value on recreational resources. However we have not yet been able to devise satisfactory methods for the economic evaluation of recreational resources.[13] We may have to develop techniques, other than market techniques, for the measurement of utility.[14] In the meantime we can do no better than rely on rather unrefined methods of measuring recreational benefits.[15]

An analysis which relies on a description of the type of recreation to be provided, the number of people to be served, the distances involved, and

the various types of alternatives may not produce a numerical value but, nevertheless, it may have a great deal of significance. Moreover, planners could be enlightened by regional or local groups interested in recreational development if these groups could justify the need for a reservoir and were prepared to assume responsibility for certain aspects of a recreational development project.

(b) The Need for Acquisition and Control of Reservoir Shore Lines

Sufficient land should be acquired around the margins of a reservoir to make recreational development possible. All too often the *take-line* is determined almost entirely by engineering considerations such as erosion hazard or inundation during periods of excessive high water. Savings in land acquisition costs may be insignificant in comparison with the total expenditure for the project but, proportionately, the gains may be quite large. Many reservoir construction agencies are reluctant to become involved in problems of administration arising from the holding of land, even though their concern with such problems may be of short duration. Frequently these agencies do not wish to become tangled up with shore line development projects – recreational projects in particular – in which they have little interest. Their chief concern is with construction and engineering work and they tend to regard recreation as an added burden. There is a basic indecision as to who should be the prime beneficiary of greatly increased land values on the margins of the reservoirs. Should the newly created values accrue to the general public who have created the reservoir or should they be left to private owners to exploit at will and possibly in a manner detrimental to the intended purposes of the reservoir?

Whatever the basic causes of the present approach to shore line control it seems imperative that prospective uses for the reservoir, particularly for recreation, must be given full consideration in the land purchase programme. The determination of the *take-line* solely on engineering considerations is obviously too restrictive since it gives little or no recognition to other uses to which the reservoir can be put.

Sometimes a sharp conflict develops between public and private recreational developments on a reservoir. A major difficulty stems from the building of private cottages along the shore line. The subdivision of land for cottage sites may be permitted, but always in accordance with the judgment of the developing agency, and ownership of the shore line should be withheld from private individuals and agencies. The shore line area must be under the control of the impounding agency to ensure that the reservoir can be adequately policed and that the major purposes for which it was constructed are not frustrated.

(c) The Need to Minimize Destructive Aspects of Reservoirs

Destruction commonly occurs when rivers inhabited by anadromous fish, such as salmon, are harnessed for hydroelectric power development. The dam impedes the movement of the fish to their spawning grounds upstream and thus leads to a decrease in the fish population. This has an adverse effect on both recreational and commercial fisheries.[16]

Dams, however, have little adverse effect on non-anadromous fish such as whitefish, pike, pickerel, and gold-eye. These fish populations usually increase rapidly during the first 10-12 years after the reservoir has been filled, and thereafter decrease and stabilize at about the previously existing level. The rise in the fish population in the first 10 or 12 years may be explained by a bountiful food supply; the cause of the subsequent decline is not well understood but is likely a function of the oxygen supply.

Bird habitats may be disturbed but the enlargement of the water surface leads to an increase in migratory waterfowl, an increase which may more than compensate for the loss of certain local species.

Animal habitats are likely to be destroyed. In some instances, the destruction of such habitat may entail the loss of educational values as well as the loss of the animals themselves. For example, an easily accessible beaver colony may have given young and older children an opportunity to appreciate the beauty and the industry of the animal kingdom.

The most grievous losses in recreational value often result from the destruction of the landscape. Unsightly borrow pits, radical alterations in the natural contour of the area, and failure to clear the trees and shrubs from shore line areas that will be inundated are of particularly significance in this respect.

Shore line clearance problems arise because, even in arid areas, the flooded river valley is usually wooded. Because of cost and other short-term considerations, the clearing of sites has often been neglected. However, these costs cannot always be avoided and if clearing is postponed until after flo-

oding they may be three or more times what they would have been before the flooding.

The trees which are killed by flooding eventually show up at the dam and then have to be removed. This is not a serious problem when the reservoir is used primarily for power. However when it is part of a multi-purpose project which includes irrigation, timber may damage the outlets to irrigation canals. When the reservoir is used for recreational purposes the shore line must be cleared of all obstructions that offer a threat to life, limb, and property (boats).

We know of three chief methods of clearing the shore line. The first one is the most popular, but not at all effective: do nothing. The second entails clearing and cleaning up before flooding, and the third clearing before flooding but postponement of the cleaning up which is done through a floatation process after the reservoir is filled. The second method is recommended for its contribution to esthetic values but the third is thought to be somewhat cheaper. In the Saskatchewan River project, young trees uprooted from the area to be flooded might well be transplanted to areas designated for park development, to hasten the day when trees will supply shade to the park visitors.

(d) Timing and Co-ordination

Maximum recreation benefits will be secured and destructive aspects adequately controlled only with proper timing and administrative co-ordination. Unless these two conditions are realized, recreational values may be seriously impaired and administrative agencies will likely face a series of crisis situations.

Recreational uses must be fully considered at all stages of reservoir planning, from the preliminary evaluation of the scheme to the final decisions on land acquisition and reservoir construction and operation.

Recreation is an explosive force, with tremendous social and economic implications, for both urban and rural people. Sound planning, that is planning that considers all aspects of a multiple-purpose project and relations between them, will minimize conflicts among uses and prevent the disruption of operational programs.[17]

Parks and recreation departments and agencies must be represented in the planning and administrative machinery set up for reservoir development. Frequently the governmental departments and agencies operating in this field are primarily interested in the engineering, agricultural, and power aspects of development, and hence recreation does not get the attention which it deserves.

There is often a recognition of the importance of the need to involve recreational agencies in the co-ordinated planning and administrative apparatus but the recreational agencies frequently are not in a position to undertake their part of the planning responsibilities because of budget or staff limitations. In the light of the sporadic nature of the need for competent staff to undertake this specialized type of recreational planning, consideration might be given to the establishment of a *reservoir* of talent to be made available on a consultant basis to provincial and municipal agencies.

Notes and References

[1] *Report of the Royal Commission on the South Saskatchewan River Project.* Ottawa, Queen's Printer. 1952, p. 253.

[2] Baker, W. M. *The Recreation Prospects of The South Saskatchewan.* Part II—*The Plan of Development.* Chapter 1 "The Intensity of Use of Reservoirs for Recreation", p. 19. The South Saskatchewan River Development Commission. June 1960 (mimeo.)

[3] *Army-Interior Reservoir Land Acquisition Policy,* Union Calendar No. 465, House Report No. 1185, 85th Congress; 1st Session, United States Government Printing Office. 1957. p. 25.

[4] *The New York Times,* August 14, 1960., p. 80.

[5] *Loc. cit.*

[6] Data from correspondence with G.W. Arthurs, Public Relations Officer, The Ontario-St. Lawrence Development Commission. Morrisburg, Ontario. October 26, 1960.

[7] Loomer, C.W. "Recreational Uses of Rural Lands and Waters". *Journal of Farm Economics,* Volume 40, No. 5. December 1958. p. 1333.

[8] Clawson, M. *Statistics on Outdoor Recreation,* Resources for the Future, Inc., Washington. April 1958. p. 7.

[9] Clawson, M., "The Crisis in Outdoor Recreation", *American Forests,* Volume 65, Nos. 3 and 4. March and April 1959.

[10] Experience in the United States indicates that recognition of public recreational values associated with reservoirs must still be fought for. On October 12, 1953, a new joint policy for land acquisition on reservoir projects was announced by the Departments of the Army and of the Interior. The effect of this policy, if it had been carried out without amendment, would have been to inhibit public recreational development on future reservoir shore lines, and to threaten the public development that had taken place on past projects. Before the announcement of the new policy and in fact even before the Flood Control Act of 1944, it had been recognized that "the recreation and conservation values inherent in the development of .... reservoirs should, where practicable, be made fully available for public use". (Committee on Government Operations, *Army-Interior Reservoir Land Acquisition Policy,* Union Calendar No. 465, House Report No. 1185, 85th Congress, 1st Session, 1957, p. 23).

According to the testimony given at Public Hearings held by the public Works and Resources Subcommittee over a period extending from June 4 to July 2, 1957, recreational development based on the policy of the 1944 Flood Control Act would have been very difficult to carry out under the new policy. At the Hearings, 48 recreation, wildlife and conservation associations went on record as being opposed to the new policy. Two organizations approved of it; these were the Chamber of Commerce of the United States and the National Lumber Manufacturers Association. (*See Ibid.,* p. 51.) As a result, the land acquisition policy was clarified in 1959 to state categorically that "federal water storage reservoirs are important elements in the nation's outdoor recreation and fish and wildlife resources." (Dept. of the Interior Information Service, August 18, 1959). And further, "Recreation and fish and wildlife opportunities, both present and potential, shall be considered throughout the planning, construction, operation and maintenance of reservoir projects..." Thus, by indicating qualitatively the value that the public attaches to reservoirs for recreational purposes, policy with respect to reservoirs was oriented more positively than before, toward recreation.

[11] This Commission was set up in the fall of 1958 by Congress, and its report is expected in 1961. See Clawson, marion, "The Crisis in Outdoor Recreation", *op. cit.,* pp. 5 and 20 in the "Resources for the Future" reprint.

[12] Johnson, Harry G. "The Political Economy of Opulence" *The Canadian Journal of Economics and Political Science* Volume 26, No. 4. November 1960. pp. 552—564.

[13] Trice, Andrew H. and Samuel E. Wood, "Measurement of Recreation Benefits," *Land Economics,* Volume 39, No. 3, August 1958, pp. 195—207. Also, "Measurement of Recreation Benefits: A Reply", *Land Economics,* Volume 34, No. 4. November 1958. pp. 356—370.

[14] For an excellent review of the work being done on utility measurement see, Arrow, K.J., "Utilities, Attitudes, Choices: A Review Note," *Econometrica,* Volume 26, No. 1., January 1958., pp. 1—23.

[15] Evaluation procedures in the United States have been summarized as follows: "Generally, the Corps of Engineers measures tangible recreation benefits by estimating the net income from recreational facilities, such as hotels, camps, and concessions. The Bureau of Reclamation obtains estimates from the National Park Service. The Department of Agriculture does not measure any tangible recreational benefits." See Subcommittee to Study Public Works, *Economic Evaluation of Federal Water Resource Development Projects,* House Committee Print No. 24, 82nd Congress, Second Session, Washington, United States Government Printing Office., 1952,. pp. 13—14.

[16] See Marts, M.E. and W.R.D. Sewell, "The Conflict Between Fish and Power Resources in the Pacific Northwest," *Annals of the Association of American Geographers,* Volume 50, No. 1,. March 1960., pp. 42—50.

[17] "... landowners, particularly resort owners around the reservoir, often exert pressures seeking to prevent necessary raising or lowering in the level of the conservation pool." *See Army-Interior Reservoir Land Acquisition Policy, op. cit.,* p. 21.

Problems and Techniques of Land Acquisition

Norah Johnson and
Joyce Tyrrell,
Metropolitan Branch,
Community Planning
Association of Canada,

Canada's public domain of about three million square miles contains an immense store of lands for future public recreational use. It ranges from far-off wilderness lands to fairly small parcels in settled areas. It can still provide many resource-based *and* consumer-based *parks. There is little question of legal power to create parks from publicly owned land but there is a question whether there is effective machinery at every government level for identifying and saving potential park lands from alienation or unwise development.*

In the populated sections of Canada, almost all lands have long since passed into private hands. The cost of recapturing these lands through purchase is high. It is the paramount problem and it can only be solved by more generous park budgets. Adequate funds are needed by every park authority to compete successfully in buying land and to move quickly when opportunities arise. Public support for an all-out park acquisition program was recently shown in a three to one vote in favor of a $75 million bond issue in New York State; "Now or Never" was the slogan.

Donation of suitable land needs to be encouraged. A full study should be made of tax benefits in the giving of parks, nature reserves or historic sites. Another slogan, "Gifts That Last Forever", is used in British Columbia.

Long term plans are needed for all growing areas, particularly to capitalize on the widely used device of subdivision control in which park areas can be obtained as a charge to the developer. More use should be made of zoning, another development control, to prevent unsuitable use of private open space.

Intensive study of ways and means to preserve the landscape and utilize the countryside for public enjoyment is imperative. Rights-of-way in the form of footpaths and bridlepaths, with safeguards for the private property owner, could literally open new horizons for nature-hungry citizens of urban areas.

The public's right to use the shore and to obtain access to navigable water needs new emphasis in view of modern recreation trends. It is evident that public access for recreation is being lost when in competition with other uses, but it is not yet clear to what extent new legislation is needed to correct this plight or whether existing legislation would be adequate if it were used more fully. Man's increasing technical ability to interchange land and water at will and thus to create or destroy the means of water access is an added challenge in the study of shore line control.

The foreshore, reserve strips that fringe the water, survey roads and public lands consolidated at the waterfront are all useful to gain public access to water but the special function of each of these is not always realized and hence the opportunity to employ them effectively is often overlooked.

The shore has become a spine, the nerve centre of public recreation linking land and water; hence access points are required to do double duty. Moreover, since the shore is the meeting ground for legislation pertaining both to the land and to the water, careful analysis of the possible conflicts is needed. At the same time, local ability to safeguard access must be supplemented by the use of powers of greater range.

There are two chief ways for public authorities to secure lands for public recreational use:

(a) By reserving land already in public ownership.

(b) By recapturing land now in private ownership through purchase, exchange or donation.

Midway between these two lie the various devices of development control such as zoning, subdivision control, and a variety of other planning measures. Parks can also be created as by-products of other public undertakings such as flood control schemes and highways.

In this paper, we shall make only brief reference to ways of preserving that part of the landscape and of utilizing that part of the countryside, which is now

93452—66

in private hands, for public enjoyment. These are aspects of the recreational scene that deserve further study.

Shore land is subject to the same laws as any other land, but it has some special safeguards. These chiefly concern public access, which in turn depends on public rights to the shore. There is an urgent need for clarification of these rights. Since demand for shoreline, particularly for commerce, industry and utilities, greatly exceeds the supply in densely populated areas, special techniques available for preserving the waterfront for public use must be fully exploited and many miles of shore must be procured for recreation.

The Reservation of Public Lands for Public Recreation.

(a) *Current Procedures.*

The national and provincial park systems of Canada originated in the reservation of publicly owned lands as did many municipal parks. The public domain will undoubtedly be the source of yet more recreation areas.

There are still vast tracts held by the federal government in the Yukon and Northwest Territories and immense provincial holdings in the unsettled or abandoned sections of the provinces. The reservoir of public lands is made up also of smaller federal holdings within provinces and municipalities and numerous provincially owned properties throughout the developed zones of Canada.[1] Cities, towns, other local municipalities and local agencies have many publicly owned properties of possible use in a parks program. A number of semi-autonomous government agencies, including regional authorities, hold land.

Within and between the various levels of government there are numerous ways to allocate public lands for parks.

Parks on Crown land in the Territories can be reserved directly by federal authorities; areas there are now being considered for establishment as National Parks. The Councils of both the Northwest Territories and the Yukon Territory are considering the reservation of land for territorial parks.

New National Parks in the Provinces are initiated by the provinces who must transfer the land they hold or acquire to the federal government. Federal lands available for disposal are offered first to federal departments, to the provinces and then to municipalities.

All provinces, with the exception of New Brunswick, have specific statutory authority to reserve Crown lands for provincial parks.[2] However, New Brunswick has created more than 50 provincial recreation areas of 1 to 50 acres.

In at least three provinces, grants of Crown land may be made for local or municipal parks: British Columbia, Ontario and Nova Scotia. In Saskatchewan, Crown lands are frequently leased to municipalities for park use and this province is unique in that the public reserves gained through subdivision control are held by the province for long-term lease to the municipalities. In British Columbia and Manitoba the title to park lands in new subdivisions goes to the province, possession to the municipality.

Regional governmental authorities are found mainly in southern Ontario where unalienated Crown lands are the exception. Such bodies as the Conservation Authorities, the Niagara Parks Commission, the Ontario-St. Lawrence Development Commission and the National Capital Commission can obtain surplus lands from other government bodies by transfer.

Provision for exchanging public for private lands is often found in park legislation and trading has proved useful in several instances.

The Federal Government and the Provinces have the power to reserve lands, which are not parklands in the normal sense of the word, for recreation purposes. Some of these powers are embodied in park legislation and some under special legislation.

The basic purpose of the national parks system is to preserve for all time areas containing significant geographical, geological, biological or historic features with artificial facilities only as an adjunct. (The Eastern Rockies Forest Conservation Area, a federal undertaking, contains camping sites.)

Under recent Ontario legislation public lands have been reserved as Wilderness Areas "for the preservation of the area as nearly as may be in its natural state in which research and education may be carried on, for the protection of the flora and fauna, for the improvement of the area, having regard to its historical, esthetic, scientific or recreational value" or for other prescribed purposes.

The provincial park Acts of Alberta, Saskatchewan, Nova Scotia and Prince Edward Island each contain provisions for conserving wildlife and preserving objects of historic or scientific interest. For these two purposes, *protected areas* may be designated in Prince Edward Island. In Nova Scotia they may be and in Alberta they must be among the uses of any park, along with recreation; in Saskatchewan any park or *protected area* can be used for either or both of these purposes and/or recreation. In Alberta a park is also a game preserve and bird sanctuary and in Prince Edward Island and Nova Scotia, part of a park may be established as such.

In Newfoundland the term *protected area* is applied to areas of natural beauty where development control should, in the words of the Urban and Rural Planning Act, be exercised to preserve natural amenities.

(b) *Some Current Problems.*

Despite the great supply of Crown land, there are problems in its allocation for public recreation, apart from the physical questions of whether the land is accessible and suitable.

(i) *Transferring Allocated Lands to Recreation Uses.*

Some public lands useful for recreation are now earmarked for another purpose. Provincial forests, game reserves and grazing lands are examples. They may have recreational values great enough to offset the uses for which they were originally reserved. The need for some change in use is recognized in Saskatchewan legislation by which all or part of a provincial forest may be designated as a provincial park. Manitoba's Whiteshell Forest Reserve already provides camping grounds, picnic areas, lodges and cabins. Ontario's Timagami Provincial Forest contains at least two small provincial parks.

There is danger of overlooking the potentialities of lands no longer needed for their original use by federal, provincial or municipal departments. The military lands that became the Canadian National Exhibition grounds, the forest station that was turned into a provincial park at Turkey Point on Lake Erie, and the garbage dump transformed by Hamilton into a landscaped park all illustrate the usefulness of *surplus lands*.

(ii) *Co-ordinating Government Land Transactions.*

Reserving and acquiring land for parks demands a high degree of interdepartmental co-ordination. The numerous bodies holding public land and the equally numerous bodies with power to create and manage parks mean that a form of clearing house is needed at the federal, provincial and municipal, if not regional government levels. There has been some movement in this direction in recent years.

At the federal level the Resources Division of the Northern Administration Branch of the Department of Northern Affairs and National Resources now controls former Ordnance and Admiralty Reserves, public lands previously administered by other federal departments and former Dominion Lands. The National Parks Branch of this department is among those to whom lands for disposal are offered.

Most provinces have branches or divisions to administer provincial parks. They are generally in a resources or lands and forests department with jurisdiction over a large supply of public land. In these conditions, the task is to obtain recognition of recreation needs by the parent department and to have full knowledge of the resources administered by other departments.

British Columbia is unique in having a Recreation and Conservation Department including a Parks Branch. The Department was set up with the intent of placing recreation on complete parity with other resource uses. In land reservation, the impetus may come from its own departmental surveys or from recommendations sent in by other agencies—Forest Service, Lands Service, Highways, Health and Welfare. The public also recommends lands suitable for park purposes.

Many provinces have set up special machinery to co-ordinate the purchase and reservation of land for parks by government agencies throughout the province. These boards or committees vary in composition from department heads to cabinet members and heads of commissions as in Ontario. The scope of these bodies and their effectiveness deserve further study.[3]

Among large municipalities with complex departmental systems, co-ordination is no less important. This may be achieved with the help of local planning departments or advisory planning bodies for one or more municipalities, charged with making surveys of land use and plans for future development. In day to day operations any local park authority should be given a fair chance to obtain available public land, perhaps by a procedure of regular notification of public properties in stock.

Through regional planning programs such as those instituted in Alberta, thorough planning surveys can be made of a wide territory centred on a major city. Public lands can be selected for reservation as parks or private recreational areas when plans are made for other urban and rural uses of land, within the planning district.

(iii) *Protecting Parklands Against Non-Conforming Uses.*

The protection of lands already allocated for public recreation uses is a major problem. Too often parks are subject to *raids* by public utility or public works agencies for incompatible uses—roads, etc., in the hope of cutting costs. The City of Toronto has had to go to much trouble to dedicate officially many properties already used for parks but insufficiently protected in legal terms. When encroachment is unavoidable, the Toronto Parks Department obtains another area, not merely of equal size, but of equal value.

93452—66½

Private recreational areas such as cottage developments have a valid claim on our public lands, but they create difficult problems if they are located within public parks. The history of national and provincial parks proves that leasehold cottage areas can become as permanent as freehold developments. A leasehold tenant may need as much security of tenure as a private owner before he can be expected to maintain his cottage at an acceptable standard. Although the leases in Algonquin Park are now being reclaimed, the high cost of leasehold properties in two other Ontario parks resulted in the outright loss of parts of the original park areas.

Ontario and Alberta have now discontinued development of cottage sites in provincial parks. In Saskatchewan, Manitoba, Prince Edward Island and Newfoundland, the provincial statutes provide for leasing in specified areas of provincial parks for residential use. In Manitoba one-half of a *recreational area* may be made up of summer home sites. But in Saskatchewan's Regional Parks, no financial assistance is given by the province for the purchase and development of land for a residential area.

Planning surveys are now under way to determine a broad policy for the use of public lands in National Parks. Until then, it is unlikely that the privilege of leasing summer cottages will be restored; at present there are no plans for establishing additional town sites or cottage subdivisions in these parks.

Recapturing Private Lands for Public Recreation Through purchase.[4]

(a) *Current Procedures*

Although the National Parks Act empowers the federal government to purchase, expropriate or otherwise acquire any lands or interests therein, the policy is to acquire lands in the provinces only when they are publicly owned and free of all encumbrances. In the Territories, the federal government would purchase directly any private lands intended as parks but this would rarely be necessary, because of the vast supply of Crown lands in the area.

All provinces except New Brunswick have some statutory authority to acquire land for provincial parks.[5] Notwithstanding this, New Brunswick, under special legislation, expropriated the land for Fundy National Park, and has provided a large number of camping and picnic parks. Quebec's National Parks Act encompasses only the individual parks the province has already established.

With few exceptions (e.g. a *local district* in British Columbia) municipalities have the power to acquire land for parks. In some municipal acts there is provision for buying land beyond municipal borders or for joint purchase. The paper does not cover the provisions within the laws of chartered municipalities.

In Manitoba and Ontario, Parks Boards that are separate from Council may be set up to provide and administer parks with funds ensured by a set mill rate (Ontario, 1 mill; Manitoba, ¾ mill-more in Winnipeg). A limit is set on the amount of land that they may administer. Incorporated villages in Prince Edward Island can set up a fund for the purchase of park land by setting aside a percentage of the taxes or a stated amount of money each year.

Regional authorities with power to acquire land for parks include the Ontario-St. Lawrence Development, the Niagara Parks Commission (the N.P.C. may float debentures), the National Capital Commission, and the Park Authorities which can be set up under the new Regional Parks Act of Saskatchewan. Conservation Authorities have been established in Ontario for many watersheds. They can establish Conservation Areas which, as a secondary use, may include recreation areas. Counties in Ontario, like any other municipality, can establish parks, as can the Municipality of Metropolitan Toronto.

(b) *Some Current Problems.*

(i) *Costs of Financing.*

Cost is the greatest problem in park land acquisition. Much of the land is required in areas accessible to urban populations where the property is in demand for other uses. The cost of purchase is therefore high, especially when the buyer is a public agency. Public authorities may balk at the high price of park land, failing to recognize the value of this form of land use in comparison with other possible uses.

The National Capital Commission has used government loans in spending $12 million for 18,000 acres of Greenbelt land. An extremely aggressive approach to the planning of parks has been taken in the City of Toronto, to establish an annual budget of $500,000 for the extension of existing parks, an additional sum for *sitting out* areas, and the earmarking of funds from the sale of park assets for further acquisition and development. Further sums are expected for the development of public and private ravine lands into a linked system of natural parklands.

The pooled resources of the constituent municipalities of Metropolitan Toronto are being used to buy land for parks of metropolitan significance, to reclaim and clear leased lands on Toronto Is-

land, and to contribute a large share of the cost of valley lands and conservation areas. A total of some 4,000 acres has been acquired over a short period.

Public agencies are frequently unable to act quickly enough in land purchase. Opportunities to acquire desirable lands at a reasonable price may be lost because funds are not available or purchase procedures are too lengthy. An adequate reserve of funds seems necessary to enable the public authority to step in quickly. However, the delays involved in public negotiations can probably be avoided only if private real estate agents carry out the purchase for an anonymous buyer. Opinions differ as to whether or not information on public transactions should be made available to the public.

The need is apparent for financial assistance to lower levels of government to encourage the creation of parks. Public enthusiasm to spend in this manner is illustrated by the three to one vote of New York State citizens in 1960 for a state bond issue of $75 million for the acquisition of land for recreation. The proceeds are to be apportioned among the State and its municipalities. Matching grants are to be allocated to cities, counties and towns for local park and recreation areas on a 75 per cent State – 25 per cent local basis. It will also provide for federal assistance when and as available.

Some provisions for direct and indirect forms of subsidy intended to further park development can already be found in Canada. Saskatchewan's Regional Parks Act and Ontario's Park Assistance Act, both recent, offer 60 per cent and 50 per cent respectively toward park costs. The municipalities that benefit under the Ontario Act must provide camping sites. The regional park authorities in Saskatchewan must provide at least five acres of land for public use. In Newfoundland where a number of companies have provided parks in or near towns where their workers live, a council may make grants or loans to any corporation created to establish parks within the municipality.

The principle of matching grants does not always offer an answer to municipalities. Even as a group, many cannot afford to pay their share. However, when the municipalities are fairly well-to-do, as in the Metropolitan Toronto Region, a 50 per cent grant under the Conservation Authorities Act makes substantial sums available for the purchase of land. Under the Canada Water Conservation Assistance Act these funds can be greatly increased by a 75 per cent federal-provincial grant for a flood control program.

Subsidized housing projects can bring new parks into central city areas. The current winter works program helps defray the costs of park maintenance and the Trans-Canada Highway agreements encourage roadside parks and camp sites.

In some cases the cost, for park developments, is restricted to a limited group of people who are considered as prime beneficiaries. Ontario's municipal legislation provides that *parks or squares* of not more than two acres may be acquired, laid out and improved with the cost charged to the adjacent owners through an equalized assessment on the land benefitted. Almost identical local improvement provisions exist in British Columbia, and probably elsewhere.

(ii) *Expropriation Powers.*

Cost problems are intensified when public authorities lack the auxiliary power of expropriation. Usually the power to *take* land is applied only as a last resort, whether or not the legislation contains a proviso that an agreement to purchase must first be sought. It is generally used to complete the purchase of a larger area so that development may proceed or to secure a highly desirable property for which the price asked is considered unreasonable.

The federal government possesses powers of expropriation for park purposes. However, it has been unnecessary to date to invoke the Expropriation Act to acquire lands adjoining National Parks. The few additions made to existing parks during the past few years have been made by purchase, following negotiation, or by donations of lands to Canada by the Government of the Provinces concerned.

Saskatchewan, the only province known to lack the power of expropriation for provincial parks, must forgo the purchase of any land for which an excessive price is asked. Alberta is now clarifying terms of its legislation which seems to restrict expropriation to the purchase of land surrounded by a park on three sides.

Generally, municipalities have the power to expropriate for parks as do the National Capital Commission, the Ontario-St. Lawrence Development Commission and the Niagara Parks Commission.

(iii) *Acquiring and Holding Lands in Advance.*
Any vigorous park acquisition program will include areas beyond the area immediately needed, to save desirable open space from unsuitable development or to avoid paying inflated prices at some future time. However, in the waiting period there may be problems of management, including the danger that the lands' recreational potential may be impaired. To lease back the land for future parks is a possible solution.

The aims of the National Capital Commission in creating its Greenbelt go beyond the securing of recreation lands, but its methods are instructive. Within the 18,000 acres already purchased, for "retaining good agricultural lands and market gardens in active operation, five year leases are being arranged. The first option for such a lease has been given to former owners. Rentals are based on the agricultural productivity of the land."[6] Lands in the vicinity of the Fanshawe Dam in Ontario have been leased back to the farmers.

Leasebacks have been successfully used in the Greenbelt of London, England, for some years. The method commends itself by providing a reserve of park land secure in public ownership, maintaining agricultural and other uses.

Difficulties of another type can occur if lands acquired in advance cannot be developed because of a tight budget. If there is a shortage of parks in a district, areas known to be held for recreation purposes can be quickly over-run before facilities are provided. This can endanger the site's natural landscape values and give rise to administrative problems as well.

(iv) *Long Term Planning.*
Whether or not plans for park acquisition are made in full view of the public, long term planning is indispensable, if only to give executive authorities a sound basis for appropriating funds. Park planning, however, should not take place in a vacuum. Co-ordination will ensure that objectives and activities of all government agencies fall within a unified pattern. A park acquisition program can thus find its rightful place within a budget that must also provide for the high cost of park development and maintenance. Intergovernmental grants can be used to their best advantage if sound plans are ready.

Securing Open Space by the Purchase of Rights in Land.
In recent years there has been considerable interest in the possibility of retaining open space for public enjoyment by purchasing only a limited number of rights in private property. Interlacing the countryside by public rights of way in the form of footpaths and bridlepaths has also been discussed.

"Purchase of development rights" was the term originally used by William H. Whyte to describe a useful method of securing open space in growing metropolitan areas. To avoid confusion with the recent British planning system, he has recently replaced it with the term *conservation easements.*[7]

Briefly, Whyte advocates buying only part of the bundle of rights in property – the right to subdivide or permit billboards, for example – while the owner keeps full title. He believes that the cost of these easements will be less than that of fee simple. Whyte argues that although this method is not intended as a way to obtain parks, it can have a pre-emptive value in providing future options on open space that, perhaps in twenty years, will be needed for parks.

It is possible, however, that only complete ownership by a public authority will allow sufficient room for change in planning ideas, unhampered by restrictions that may become inapplicable. Canada's National Capital Commission has looked into the possibilities of buying development rights within its Greenbelt. Some of its conclusions were as follows:

(a) This device could not guarantee absolute security in perpetuity, being essentially an agreement good only during the life of the land owner;

(b) in a metropolitan area, development rights would make up a substantial part of the total cost of the land; and

(c) use of the land by the federal government in the public interest calls for outright purchase.

This subject should be pursued further, to include a close study of England and Wales' National Parks and Access to the Countryside Act. The provisions of the Act for footpaths and bridlepaths, long-distance routes for travel on foot or horseback by creating new rights of way are of special interest. Canada has almost no tradition of public rights to passage over private land. It is perhaps more than high time to institute such a tradition. Our shore lines and open country, areas of natural beauty within and beyond our cities, although in private ownership, could thus be enjoyed by the public, with safeguards for the rights of the landowner.

Recapturing Private Lands Through Donations.
The power to accept gifts of land for parks is spelled out in the provincial park legislation of all provinces except Manitoba and Quebec. The term *otherwise acquire* in the National Parks Act and in Manitoba's park legislation no doubt covers the receipt of gifts. Que-

bec's National Parks Act provides for the establishment of specified parks: Laurentides, Gaspesian, Mount Orford, etc. British Columbia's and Alberta's Acts provide also for gifts of money.

Gifts are provided for in the Municipal Acts of Ontario and Manitoba, in Saskatchewan's Regional Parks Act and in the Acts establishing the Niagara Parks Commission and the Ontario-St. Lawrence Development Commission. There is little chance of a legal obstacle preventing the donation of land to any municipality.

Much more can be done to encourage gifts of land. A leader in this field is British Columbia where no fewer than 28 provincial parks, totaling about 3,270 acres and ranging in size from two to about 750 acres have been donated. [8] The donors include municipalities but more often individuals and companies. Each gift is acknowledged by a plaque on the site and by mention in a handsome brochure which invites further donations by others.

Not all offers of park land are acceptable. In Ontario, for example, offers of land for provincial parks have sometimes been refused because the properties were too small (areas of 500 acres or more are preferred), not well related to other parks had cumbersome conditions attached, or were somehow uneconomic to develop. Although the City of Toronto has recently accepted a five-acre estate with the condition of lifetime residence by the donor, a number of pieces of land given to the city have been judged undesirable as parks and disposed of.

In Canada, some consideration should be given to changes in the legislation to encourage the flow of bequests and gifts to park authorities. From a cursory study of tax legislation, it seems that a gift of land for parks can already bring some benefits to the donor and his beneficiaries in matters relating to income and estate taxes. However, the entire matter clearly needs thorough and expert legal study covering the situation with regard both to public agencies and to trusts or foundations. [9]

The foregoing remarks with regard to the encouragement of donations for public parks apply with equal force to historic sites and nature reserves. As for historic sites, it has been suggested that consideration be given to extending lending facilities under the National Housing Act for the restoration of the fabric of many historic buildings in Canada.

Many areas of recreational value are not amenable to the available methods of acquisition or development controls. But, in the care of a *park trust,* such as England's National Trust or the United States' Nature Conservancy, they could be saved for public enjoyment. Even in southern Ontario, where a plethora of park authorities provide anything from playgrounds to National Parks, not all the types of needed open space, public or private can be secured. The Niagara Escarpment is an example of a recreational resource now in jeopardy.

The advantage of a trust or foundation which can accept and manage land depends on the adequacy of the funds it has to maintain and administer properties in its possession, and its ability to offer tax relief. Provincial bodies would probably be preferable to a national trust, to secure local interest and supplement the provincial park programs. Much would depend on the publicity given a provincial trust, and even more on financial support from public sources.

Obtaining Parklands through Development Control Measures.

The term *Development Control* covers the various means by which public authorities, generally working under provincial community planning legislation, may secure privately owned lands in developing areas for public parks, apply regulations to ensure a desired amount of open space (zoning), or reserve privately owned lands for eventual acquisition.

Development control measures are used chiefly by municipalities. [10] However, federal and provincial authorities may influence development as can be seen in the land assembly projects under the National Housing Act, or the zoning regulations which may be made by the Newfoundland Provincial Planning Advisory Board.

(a) *Subdivision Control.*

The most frequently used method to obtain public parks in areas under development is that of subdivision control. The developer is required to provide a ratio of his land for public uses (other than roads) as a condition of permission to develop.

The federal government subdivides Crown land for building purposes in the Yukon and Northwest Territories and has created numerous townsites and subdivisions in National Parks. The Central Mortgage and Housing Corporation plays a large part in federal subdivision design and co-operates with the provinces and municipalities in planning land assembly and other housing projects, taking care to provide well-located public open spaces.

Among the provinces, Alberta, Saskatchewan, Ontario and, most recently, Quebec appear to have the most highly developed systems for reserving park land written into their general statutes. Detailed regulations have been made in Alberta and Saskatchewan. In Ontario and Saskatchewan the provincial

government sets similar standards when public lands are subdivided for resort development.

The following table shows, very broadly, the main features of the provisions in these provinces. The amount of land required from the subdivider is expressed as a percentage of the whole subdivision. The uses to which the open space can be put and the alternative requirement of cash in lieu of land are indicated. In Saskatchewan, the reserves are vested in the province and leased to municipal authorities, usually for 99 years.

	Alberta	*Saskatchewan*	*Ontario*	*Quebec* (cities and towns)
Amount	10 per cent plus areas unsuitable for building	5 per cent, 10 per cent if more than four families per acre	5 per cent	5 per cent
Uses permitted	park school other community or public purpose	park school public purposes public building	public uses (policy to encourage parks only)	parks
Cash option	–	–	if official plan for parks public land fund	yes park fund

Except for British Columbia, all provinces provide some means of securing park land from subdividers, as do some chartered municipalities. In contrast, British Columbia takes the view that the entire community rather than the newcomers should bear the costs of open space. Its subdivision control legislation therefore contains no such requirement. In Manitoba, the community planning law does not provide for a fixed percentage but provincial authorities may recommend minimum sizes of park sites.

There are a number of problems associated with the use of subdivision controls as a technique for the acquisition of public recreation areas.

Frequently municipalities cannot afford to develop the park land set aside through subdivision control. In a raw undeveloped state its recreation value is limited and the longer it remains in this condition the greater the risk that it may be diverted to other uses.

An arbitrarily chosen piece of land may be of the wrong size and in the wrong location for the needs of the subdivided area or the community beyond it. By trading, selling or taking cash in lieu, better areas may be secured. The surest way of deploying the lands or funds to the community's best advantage is to have ready a comprehensive plan for a park system, providing for the selection of suitable lands in the proper amount. Plans of this type are unfortunately not always available. Ontario, for this reason, ties the power to obtain cash in lieu to the adoption of an official plan. Such plans have been put into force in Ottawa and in the Township of Etobicoke.

A single fixed proportion of land for open space in a subdivision does not take account of variations in the density of a new development. The open space provided should be related to the number of people expected to use it and scaled to the proposed density of building. Saskatchewan is unique in having such a provision in its legislation.

(b) *Homologation.*

A planning tool of long standing in Quebec, this form of deferred acquisition can be used by cities and towns in that province. A council may designate *public places* by plans binding on the owner for five-year renewable periods, reserving the land until the municipality acquires it. The owners may not claim compensation or damages for any building or improvement erected after the designating by-law is passed.

(c) *Master Plans or Schemes.*

Without reviewing the great range of community planning powers from province to province, attention may be drawn to two instances of deferred acquisition powers that can result from the wholehearted use of planning legislation.

Development Scheme by-laws in Alberta allow for the reserving of land for future purchase, including the sites of schools, parks or other open spaces. In Newfoundland, development lines may be used to designate public open spaces, fixing and limiting the compensation payable when the land is acquired.

(d) *Zoning.*

Zoning is a regulatory control, commonly applied by municipalities and intended to prevent undesirable uses of land by private owners. Generally, land may be zoned for parks only if a reasonable number of similar private uses are allowed. It should be noted that in a recent Regina court case, the right of the city to zone land for parks was upheld. Mr. Justice

Graham pointed out that all such legislation is confiscatory but nonetheless is valid and necessary.

In Ontario and Alberta, municipalities can establish zoning districts permitting only low density residential uses and private open space in the form of farms, forest lands and golf clubs. In Newfoundland a Municipal Plan can lead to the adoption of a zoning scheme in which the other uses of parks or land designated for recreation can be prevented but there is a proviso for compensation of owners. Also in Newfoundland, there are general provisions which allow the province itself to zone lands in designated *protected areas*, and along designated *protected roads* for one quarter mile on each side, to preserve natural amenities. [11] With similar intent, the province of Alberta has for many years controlled development along its highways.

(e) *Tax Measures.*

Of possible interest as ways of preserving open space are two provisions of the Ontario's Assessment Act. First, a municipality may place a fixed assessment on a golf course. When the course is used for another purpose, the owner may either require the municipality to buy the land for the amount of the fixed assessment or he may pay the sum of the yearly difference between taxes on the fixed and the regular assessment plus four per cent interest. This provision has been used and no difficulties have been reported. This device is of interest in protecting marinas, which, like golf courses, demand special site conditions that are not readily found. Second, in assessing farm land, no consideration is to be given to the sales value of other farm land in the vicinity which has been sold for other purposes.

Securing Parklands as By-products of Public Undertakings.

Public authorities do not always take advantage of the open spaces around public projects and buildings for inclusion in a park system. New projects can often be planned with recreation in view. Even short term park use of land for a major public project while it is vacant, perhaps as a result of demolition, may be worthwhile.

Roadside rests are becoming an integral part of present-day highway planning in many provinces. [12] The highly popular recreation grounds in southern Ontario's Conservation Areas are actually a by-product of the primary flood control programs. Along the Great River Road of the Mississippi, highway and conservation funds were combined. On the local scene, municipalities sometimes combine park and school sites to their mutual advantage; however, it has yet to be settled everywhere that school playgrounds can be made part of a local park system.

The Provision of Public Access to Water. [13]

(a) *The Significance of the Problem.*

The shore is the gateway to the water; the use and enjoyment of water largely depend on access via the shore. Shore differs from other land because it belongs to water as well as to the land itself. It is subject to all controls of land use, plus some additional safeguards which its exceptional function demands. We are in a period when the whole concept of shore line use and preservation is being moulded to meet new demands. [14] In today's explosion onto the water, the shore is no longer merely an edge; it has become a spine, the nerve centre of public recreation.

All the tidal waters and the inland navigable lakes and rivers of Canada form a vast public domain, a domain which may be entered upon only by those who have access to the shore. Entry by float-equipped aircraft directly onto the water is, of course, also access, but without a base on shore public use would be negligible. Water access may thus be thought of as access to, access along, access onto, and access from. Preservation of this land depends upon two things; the common law rights of the public to the foreshore and in addition, safeguarding of sufficient shoreland for public use.

Although this paper deals specifically with the means of procuring water access, it is impossible to divorce provision of access from the further questions. "Access for whom?", "Access for what?". For whom? – for permanent residents and communities situated near the water; for seasonal residents (cottagers); for "weekenders" (the motoring public); for those aboard cruising pleasure craft seeking harbors. For what? – for sports, including fishing; for beachcombing and clamming; for the sense of space, contrast, vitality and adventure of water.

Fundamental questions remain: Is waterfront land to be regarded as a speculative commodity or as a public heritage? If as a public heritage, then how can water access be preserved for public use? In what places? By what means?

Ironically, though the shore is probably the foremost recreational area today, almost all the legislation concerning it was written with something else in mind, namely, land laws for settlement and water laws for commerce of the sea. The recreation water-

front is a twilight zone where legislation is not clear. "If you float you are Federal, if you sink you are Provincial", refers to federal control of navigation and provincial ownership of land under navigable water. Beds of canals are federal, for instance, but who owns the beds of the reserve lakes of the canal systems? How are houseboats, riding at anchor, to be controlled? – and so the questions go.

Waterfront lands often fail to be acquired for public use because of the complexity of purchase. This is understandable since negotiation for one parcel of shore may run the gamut of legislation from municipal control, through provincial and federal Acts, to international laws of navigation. On the Metropolitan Toronto waterfront, for instance, over thirty different public bodies have some jurisdiction. It is small wonder that public recreation needs on the waterfront often become sidetracked by municipal authorities. Frustration at the paper work involved in such cases has deterred both public and private bodies and hence marinas and other facilities remain unbuilt, even in places where they are urgently needed.

Fortunately, powers that sometimes clash can also be harnessed for joint achievement. It was this joint use of powers that made the Seaway possible and which has, in Metropolitan Toronto, combined conservation and municipal parks powers to create great recreation areas.

(b) *Providing Access by Means of Survey Roads.* Large regions of Canada do not yet have cadastral surveys and hence, in these places, the opportunity to use the road pattern to good advantage for water access is still open to use. In the settled parts of the country the situation is different since the survey network is already set into some variety of grid pattern and sooner or later these straight lines intersect the shore lines which lie in their path. This pattern does at least give some water access but it is very rigid and even in the populated southern and resort sections of Canada, there is only a road allowance to water on a rough average of one in a mile. Since many of the roads which do reach water are not kept up, this survey fabric must obviously be adapted or supplemented before good water access is attained.

Chief exceptions to the grid network of roads occur where settlement preceded surveys and roads found their own way, or skirted water, except at fords and main harbors. Many parts of Atlantic provinces had few roads running to water shown on surveys, but since water was often the highway, trails found their way up from coves and harbors to the roads behind. Nova Scotia attempted, and then gave up, the idea of running surveyed roads to the water; instead, the Angling Act was passed to give fishermen the right of access to the shore.

In some mining areas of Ontario the surveys do not provide for roads, but only for a percentage of land reserved for roads, to be charged against owners and placed where they wish. Thus a lake may be ringed off so that the public is excluded.

Road allowances as a form of public access are frequently subject to serious physical limitations in that they lead to points on the shore line where there are cliffs or swamps, etc. For this reason, they do not afford opportunity for swimming or for launching a boat or even for walking along the shore. Many such roads have never been opened up or *unstopped,* nor is their future opening likely.

In general, public authorities today do not seem to express much concern over encroachment of road allowances and shore reserves by squatters or private owners, though this situation is widespread. It is on record, however, that one of the purposes of the original shore line survey roads was to curb these conditions. Enforcement obviously has not kept pace with the original intent. Saskatchewan is now attempting to clear lake shores by gradually moving the shore squatters' cottages and boat houses to a planned subdivision. In Ontario, a Judge's plan was placed on such an area as a basis for negotiations.

The running of fences down to and out into the water is the commonest form of encroachment. This is closely allied with the custom of watering livestock via the public rights of way to the shore and involves problems of health as well as those of access.

The closing of roads leading to lakes and streams represents a constant threat to water access. In recognition of this danger several provinces have taken steps to safeguard public interests. In Ontario, an ordinary road may be closed by the local or provincial authority but a road running to or along water requires a special order-in-council. Whenever the Lieutenant-Governor-in-Council has been reluctant to relinquish such reserves without good reason, water access policies have been strengthened.

Public access is frequently lost when land is subdivided. Old survey roads then become obsolete and it is reasonable to close them at that time. To obtain the order-in-council to do so in Ontario the subdivider may be required to set aside an appro-

priate amount of alternate land for public purposes, and he may further be required to place such land in a block or blocks, adjacent to the water. Because the subdivider will absorb the acreage of the closed roads into the land which he is permitted to sell, it is therefore considered fair that he return to the public an equivalent in land and in water access.

Finally, it is necessary to ensure that sufficient water access roads are created in shore subdivisions over and above those provided by the original survey system. British Columbia requires access strips 200 feet wide every 4,000 feet in the case of small holdings surveyed by the Crown. (The extra width supplies parking as well as access.) Furthermore, subdivision on the shores of navigable waters in organized territory requires access roads at distances of not greater than 10 chains between centre lines. Likewise in Ontario, as a general policy, either a road to water or a waterfront park is usually incorporated at half-mile intervals into the subdivision design.

(c) *Providing Access by Reservation.*

Having once recognized the principle of public rights to the foreshore, and having grasped both the possibilities and the limitations of survey roads as a way to water, each government then casts about for further means of safeguarding public access.

For Crown lands, two chief methods are used to preserve public access along the water's edge; a strip of a set width, variously referred to as a fringe shore reserve, chain reserve, ribbon, or buffer strip, and a system of reserving blocks of land or special sites at intervals along the shore. The first method gives continuity and checks encroachment onto the foreshore; the second, depth and flexibility. They are often used in combination.

Most provinces now provide for some fringe reserves and these vary in width from one to three chains (66' to 198'). Ontario has an additional provision prohibiting the surface working of mines on Crown land to be nearer than 400 feet from the shore of a lake. By policy also, when timber rights are given, trees are usually not permitted to be cut close to the shore of navigable water. The distance is often 300 feet but it varies at the discretion of the minister. Also in Ontario, free right of passage over a portage which has existed or now exists is reserved wherever public lands are disposed of. The Federal Government, through the Department of Northern Affairs and National Resources, requires a reserve of 100 feet around all navigable bodies of water in the Territories.

Block reserves are a common feature in many provinces when lands are subdivided. On Crown lands in Ontario 20 percent of the land, or two blocks in ten on water, are reserved to the province in addition to the fringe shore reserve. This province further stipulates that if such land is alienated and is subsequently subdivided and offered for resale within five years, then one-quarter of the acreage of all lots and blocks revert to the Crown. Thus undue speculation is checked. In Saskatchewan a serious effort is being made to ensure that public reserves (on subdivision) on private land are located so as to provide public beaches and access to water.

The right of *common user* is a method used in Ontario to procure a park in a subdivision, in absence or default of a local municipality ready to assume it. The device of creating an area owned and used in common by some or all of the landowners of the subdivision, can be used to provide a common waterfront. While this device is better than no park, it is not *public access* in the true sense.

British Columbia adopts the following procedure to ensure that adequate public reserves are provided to shore line areas.

> (i) Upon receipt of an application by a private individual to acquire Crown waterfront lands, a careful review of all surrounding waterfront is made to ensure that public recreational requirements have been provided in the form of established reserves. If public recreational aspects have not been provided for, or if established reserves are considered inadequate in the long-term view, such requirements are given prior attention.
>
> (ii) When adequate areas of first-class recreational value have been set aside, remaining Crown lands of that class, and areas representing second-class recreational values, may be designated for possible private alienation on a leasehold basis. Leases for private homesite purposes are restricted to a maximum of three chains water frontage. Where commercial use is planned, areas may not contain greater than ten chains water frontage, depending upon proposed use.
>
> (iii) Consideration is given to alienation by purchase, only in instances where the Crown water frontage contains no potential whatsoever for development for public recreational use. Water frontage in this category is still restricted to three and ten chains frontage for private and commercial use respectively." [15]

The Department of Northern Affairs and National Resources reported its intention to carry out a reconnaissance of lakes in the Yukon Territory during the summer of 1961 for the purpose of reserving the best sites for public use. The element of judgment in choice of the *best* sites puts heavy responsibility upon the men in the field.

(c) *Providing Anchorages, Launching Sites, Water Parks and Marinas.*
With increased boating activities the provision of these facilities has become a critical problem in many areas. Anchorage for the great new fleets of houseboats and cabin cruisers is in demand, not only close to marinas, but in more remote coves and inlets and in water parks as well. Ontario is now reserving small boat anchorages, these being described as "public lands covered with water ..... bordering on public lands not covered with water". British Columbia is not only reserving *harbors of refuge* but has in operation four Marine Parks, "dedicated to the boating public", in which access is by water only and shore facilities are deliberately kept to a minimum.

British Columbia also reserves small wayside launching sites at places where a road comes close to water. These are *grabbed* when available and if feasible they may later be linked with a park. Saskatchewan and other provinces also provide numerous launching sites. In some provinces roads themselves have been converted to launching ramps, by continuing the hard surface of the road out under the water. The Ontario-St. Lawrence Development Commission is using stretches of the old, half-flooded No. 2 Highway, from Toronto to Montreal, as elongated ramps.

Numerous privately owned marinas are now in operation but British Columbia and Ontario have also reported marinas developed on public land. British Columbia reserves the land and then leases it. Ontario's first public marina was built by the Ontario-St. Lawrence Development Commission on their land and the concession then rented.

(d) *Providing Island Access.*
This concerns both the convergence of islanders onto the mainland access points, and the ringing of the shores of large islands with private development so that neither public wharfage is available nor is access to the interior of the island retained. The problem is particularly acute in the Thirty Thousand Island region in Ontario and off Vancouver Island in British Columbia.

(e) *Providing Public Access for Fishing.*
The ramifications of this problem are too many for elaboration in this paper, but the matter is urgent. Control of the water, common law rights on shore and on navigable waters, ownership of the land under the water, riparian rights, special private fishing licenses, fishing privileges and restrictions relating to bridges and other public works, and the whole subject of fishing easements are all involved.

Ontario Foresters have suggested two devices to provide fishing access in congested areas: to build fishers' platforms in connection with bridges, and to build fishermen's piers out from beaches to deep water. These devices will benefit fishermen who do not use boats or cars.

(f) *Land Under Water and the Changing Shore Line.*
Land under water is assuming increasing importance to public recreation as modern engineering presents new uses and new threats to it. Great areas of land and water are being altered by dredging, fill, and by modern uses of concrete and the means of pile driving. Water levels are being altered at will and this is closely related to access, as witness the Seaway. [16]

This changing shore line presents challenging problems of public access on which study is urgently needed. Awareness to these needs is reflected in the reported tightening of controls of land-under-water by all governments and in many cases, an outright refusal to allow such land to go out of public ownership.

Glossary

Access	Any road, path or parcel of land by which the public may, without trespassing, reach water or may travel along the shore.
Foreshore	The land between low and high watermark. It is, in general, the area on which, by common law, the public has a right to come and go, to land on from the water, and to use to earn a living, e.g. fishing and lumbering. The public *right* to the foreshore for recreation has not, to the writers' knowledge, been tested in Canadian courts, though it has been tested in both English and U.S. state courts, with varying results. See bibliography. The above right refers only to navigable water.

Marina — A waterfront servicing area designed for small pleasure boats and their crews. Marinas supply slips but not necessarily anchorage.

Navigable Water — For purposes of this paper, navigable waters are public waters, that is to say, waters to which the public has right of entry. Both the land under such waters and the adjacent foreshore are public unless specifically alienated. This definition is greatly oversimplified and for further reading concerning this very controversial subject, the reader is referred to the bibliography. In the Atlantic provinces, only tidal waters are navigable: west of Quebec, all but the smallest water-bodies are navigable unless alienated. This includes the Territories.

Riparian Rights — In non-navigable streams, a riparian owner's rights go to the central thread of the stream, i.e. he owns the water-bed and the water is *private*. This, too, is oversimplification of a very ambiguous subject.

Shore — Used in a general sense to include the foreshore and land adjacent to it, whether inland or outward under water.

Waterfront — Used to include both the shore and the activities connected with water, i.e. boating and swimming as well as on-shore recreation. In context, it also includes other waterfront activities, i.e. commerce and industry and public utilities.

Water Parks — Also called *Marine Parks*. These are water areas controlled by park authorities. They are in contrast to parks located on the shores of navigable water which is shared by other uses and which is under federal control.

Bibliography

Ackerman. *Water Resources in the U.S.* Resources for the Future Inc. Reprint No. 6 March 1958. Washington 6, D.C.: R.F.F. 1775 Massachusetts Avenue N.W.

Adams, Thomas. *Rural Planning and Development.* Canada Commission of Conservation. Ottawa. 1917. p. 281

Ahrens, R.H. *Selection of Reserves for the Use, Recreation and Enjoyment of the Public.* Paper delivered before the lands Branch, Department of Recreation and Conservation, British Columbia. n. d. mimeo. p.6

American Institute of Park Executives. *The Crisis in Open Land.* Park Education Program of A.I.P.E. Oglebay Park, Wheeling, West Virginia. (Alfred B. LaGasse, Executive Secretary) 1959. p. 26

Annual Reports of Federal and Provincial Departments.

Anonymous. Ottawa, The National Capital Plan, in *The Canadian Architect,* Hugh MacLean Publishing Company, Don Mills, Vol. V, No. 5. May 1960.

Anonymous. Waters and Watercourses, in *Canadian Encyclopedic Digest.* 11 CED (Ont.) 1932. p. 75.

Architectural Forum. *The City's Threat to Open Land* New York: Time Inc. Rockefeller Centre, N.Y. 20 January 1958.

Armstrong, Alan. "Thomas Adams and the Commission and Conservation". in *Plan.* Vol. 1, No. 1. 1959.

Baiden, R.M. "How Canadians Spend Their Holidays", in *Saturday Night.* Consolidated Press Division, Toronto. August 20, 1960. p. 7.

Bell, George T. *Dedicated and Deeded Property for Parks and Recreation.* A paper delivered before the Parks and Recreation Association of Canada at the Annual Conference, Regina. 1958. (Association Secretary, Mrs. D.C. Owen, 77 Warden Avenue, Mimico, Ontario). mimeo. p. 17.

Bowers, Renzo Dee. "What is Public Fishing Water?", in *Sports Afield.* March 1952.

Bray, A.S. *Land Use Planning for Recreational Use.* Address given before the 22nd. North American Wild Life Conference. Washington, D.C. March 1957.

British Columbia Department of Lands and Forests. *Alienation of Crown Lands Fronting Upon Lakes.* (A circular letter from the Minister, pursuant to the Land Registry Act. July 23, 1958).

British Columbia Department of Recreation and Conservation. *Gifts That Last Forever.* Parks for the People of British Columbia. Victoria: Parliament Buildings. 1960. p. 5.

California. *Public Outdoor Recreation Plan.* Part 1. Sacramento: Documents Section, State Printing Plant. 1960. p. 81.

Canada Department of Transport. *Safety Afloat.* Ottawa; The Queen's Printer. 1960. p. 40.

Canada Federal District Commission. *Fifty-ninth Annual Report.* 1958. Ottawa. p. 74.

Canada National Capital Commission. *Sixtieth Annual Report.* 1959-1960. Ottawa. p. 46.

Canada Senate Standing Committee on National Resources. "Tidal Water". Nov. 21, 1957.

Canada Year Book. 1951. *Municipal Government.*

Canada Year Book. 1959. *Provincial Parks.*

City of Montreal. *Open Spaces* Montreal Master Plan. Montreal City Planning Department. 1955. p. 51.

City of Ottawa. The Official Plan of Parks and Recreation Areas and The Planning Survey of ... Parkland Sites for the City of Ottawa. Ottawa City Hall. May 1960. mimeo. p. 37.

City of Toronto. *The Changing City.* A Forecast of Planning Issues for the City of Toronto, 1956-1980. Toronto City Planning Board 129 Adelaide St. W. November 1959. p. 48.

. *Natural Parklands.* Toronto ibid. June 1960. p. 30.

. *Waterfront Proposals.* Toronto ibid. March 1960.

Clawson, Marion. *Land for the Future.* Johns Hopkins Press. 1960.

. *Resolving the Crisis in Outdoor Recreation* A paper given before the Seminar on Parks and Nature Reserves in Ontario. September 1960. Toronto Conservation Council, 85 King St.E. mimeo. p. 11.

. *The Role of State Parks in Meeting the Recreational Demands of the Future.* Resources for the Future Inc. 1960. Washington 6, D.C.: 1775 Massachusetts Ave. N. W.

Community Planning Association of Canada, Greater Toronto Branch. *The Waterfront of Metropolitan Toronto.* A Brief presented to Council of Metropolitan Toronto, June, 1959. Toronto, The Secretary, Ontario Division, C.P.A.C. 32 Isabelle St. mimeo. p. 8.

Conservation Council of Ontario. *A Report on Land Use.* Toronto: 85 King St. E. September 1, 1960. p. 39.

Corporation of Metropolitan Toronto. *Draft of Official Plan of Metropolitan Toronto Planning Area.* Toronto Metropolitan Toronto Planning Board, 790 Bay St. 1960. p. 272.

Coulson, H.J.W. and Forbes, U.A. *Law of Waters.* London, Sweet and Maxwell. 1952. p. 1320.

Edmunds, Allen T. *Water and the Recreational Use of Land.* A talk delivered before a Conference on Water Availability and Pollution, London, Ontario, October, 1960. Toronto Conservation Council, 85 King St. E. p. 10.

Fitter, Richard. *Countryside Vigil. Lost Coastline.* Observer. May 22, 1960. London, 22 Tudor St. E.C. 4.

Fleming, Donald M. "Navigable Waters as Boundaries" in *Boundaries. Canadian Encyclopedic Digest (Ontario).* Second Edition, Vol. 2. (2 C.E.D.).

Garmhausen, Wilbur J. *Ohio's Roadside Rests.* Ohio Department of Highways, Columbus, Ohio, p. 11.

Gibson, Edward *The Geographic Basis of the Lake Erie North Shore Section of the Great Lakes Parkway*. Thesis. University of Western Ontario. 1958.

Great Britain. *National Parks and Access to Countryside Act. 1949*. London: H.M. Stationery Office, York House, Kingsway, W.C.2.

. *National Trust Acts*. ibid.

National Parks and Access to the Countryside. 1950 H.M. Stationery Office. p. 16.

. National Parks Commission. *Tenth Report*. 1959. H.M. Stationery Office. p. 60.

. Nature Conservancy of Great Britain. *The First Ten Years*. Report. London, 19 Belgrave Sq. S.W. 1. p. 32.

. Press and Information Division. *Green Belt Around London*. September 1956. London County Hall, S.E. 1. p. 36.

. Central Office of Information. *Town and Country Planning in Great Britain*. July 19. 1959. London, Central Office of Information. p. 32.

Haig-Brown, Roderick. *The Crisis in Outdoor Recreation*. A paper delivered before the Seminar on Parks and Nature Reserves in Ontario. Toronto. September 1960. Toronto Conservation Council, 85 King St. E. mimeo. p. 10.

. *The Vanishing Parklands and Public Conscience*. Saturday Night. Consolidated Press Division. Toronto. May 14, 1955.

Humphreys, C.R. *The Place of Wildlife in State Water Use Legislation*. Dept. of Resource Development, Michigan State University. July 1957. mimeo. p. 9.

Higgs, K.G. *Recreation and the Metropolitan Toronto and Region Conservation Authority*. Paper delivered before the Seminar on Parks and Nature Reserves in Ontario. September 1960. Toronto Conservation Council, 85 King St. E. mimeo. p. 10.

Hyman, Ralph. *The Loveliest Thousand Acres in Vancouver*. The Globe Magazine, September 7, 1957, The Globe and Mail, 140 King St. W. Toronto

Lothian, W.F. *A Brief History of the National Parks Administration in Canada*. National Park Service. Department of Northern Affairs and National Resources. Ottawa. 1955.

McLean, W.A. *Planning Conservation Areas*. A paper presented at Ontario Conservation Authorities' Conference, Preston, Ontario. Oct.-Nov. 1960. Woodbridge, Ontario: Metropolitan Toronto and Region Conservation Authority. mimeo. p. 11.

McMurray, Norah. *Outlines of Canadian Planning Law*. Ottawa Community Planning Association of Canada, 425 Gloucester St. 1952. p. 80.

Moses, Robert. *Future Suburban Parks*. A Suggestion to the International Recreational Congress. Philadelphia. September 30, 1956.

Mumford, Lewis. Social Function of Open Space. Address to International Federation of Landscape Architects. 1960.

National Advisory Council on Regional Planning. *A User-Resource Recreation Planning Method*. Washington 6, D.C: Resources for the Future. 1775 Massachusetts Ave. N.W. 1959.

New York State Conservation Department. *Now or Never. A Bold New Program for Outdoor Recreation*. Introductions by Harold G. Wilm and Robert Moses. Albany. 1960.

.*Outdoor Recreation Survey*. N.Y. Conservation Department. ibid. February 1, 1960.

New York State Council of Parks. *Principles Governing the Establishment Extension and Development of the Park and Parkway System of New York State*. (Chairman, Robert Moses, Long Island State Park) n.d. p. 9.

New York Times. *Conservation; The Parks Issue*. Forest Services Policy. New York Times. Sunday, November 13, 1960.

Nova Scotia Department of Parks. *Policy for Provincial Parks*. Halifax. n.d. mimeo. p. 37.

Ontario Department of Commerce and Development. *Conservation Authorithies in Ontario*. Progress and Achievements. The Queen's Printer. 1960. p. 72.

Ontario Department of Mines. An Expanding Empire. Annual Report, 1959. The Queen's Printer. Toronto. 1960. p. 140.

Ontario Department of Planning and Development. "Resort Subdivisions". in *Ontario Planning*, November 1953.

. "Five Percent Lands. What and Why," in *Ontario Planning*. August-September 1959.

. "Five Percent Lands. Conditions of Approval", in *Ontario Planning*. November 1959.

. *Annual Reports of Ontario-St. Lawrence Development Commission*. Queen's Printer. Toronto. 1958 and 1959.

. *Preliminary Report*. St. Lawrence Area Study on Recreation. mimeo. 1959.

Ontario Select Committee on Conservation. *Report to the Ontario Legislature*. Queen's Park. Toronto. 1950.

Ontario Select Committee on the Lake Levels of the Great Lakes. Report to the Ontario Legislature, Queen's Park. Toronto. 1950.

Ontario Water Resources Commission. *Management of Wetlands*. Conference. Queen's Park. Toronto November 12, 1959. mimeo. p. 74.

Parent, Honore, City Planning and the Law. Reprint, in *Housing and Community Planning*, McGill Monograph Services. Montreal. No. 4. 1944

Parks and Recreation Association of Canada. *Procedure and Method of Land Acquisition*. Report presented at the Annual Conference, St. Catharines Ontario August, 1960. (P.R.A.C. Secretary, Mrs. D.C. Owen, 77 Warden Ave., Mimico, Ontario).

Patrick, N.D. *A Preliminary Assessment of the Situation in Ontario with Regard to Public Access to Fishing Waters*. Fishing and Wild Life Branch, Department of Lands and Forests. Toronto. 1960

Pleva, Edward G. *The Basic Need for Recreational Land*. A paper delivered before the Seminar on Parks and Nature Reserves in Ontario. Toronto. Conservation Council, 85 King St. E. mimeo. September 1960. p. 8.

. *The Proposed Great Lakes-St. Lawrence Parkway*. A paper delivered before the Annual Conference of the Community Planning Association of Canada, Montreal, Sept. 1959. Ottawa: C.P.A.C. 425 Gloucester Street. mimeo. p. 11.

Preston, Donald R. *How to Get Municipal Park Sites*. The American City. April 1959. p. 3.

Recreation (Magazine). *Relationship of Highway and Recreation Planning*. New York: National Recreation Association, 8 W. 8th Street, N.Y. 11. March 1958.

Romney, Henry. "A New and Human Science", in *Sports Illustrated*. March 28, 1960, Chicago: 540 No. Michigan Ave.

. "Social Conservation. Trail Blazers in California", in *Sports Illustrated*. ibid. April 4, 1960.

Roy, Paul. "Relax in Quebec's Parks and Preserves", in *Rod and Gun-Forest and Outdoors*. Beaconsfield Quebec: 58 Madsen Ave. May 1960. p. 2.

Russell Sage Foundation. *Regional Survey of New York and its Environs*. Vol V. 1928.

Saskatchewan Department of Municipal Affairs. "Subdivision Plans as they Relate to Summer Resort Developments", in *Municipal Topics*. Series from December 1957 to April 1958. mimeo. p. 6.

. "Regulations Respecting the Administration of Public Reserves", in *Saskatchewan Gazette*. n.d. mimeo.

Siegel, Shirley. *The Law of the Open Space*. Park, Recreation and Open Space Project of the Tri-State New York Metropolitan Region. Regional Planning Association. N.Y. 36: 230 W 41st St. N.Y. 1960. p. 72.

Spence, H. *Horticultural Development of Ontario's Provincial Highways*. Ontario Horticultural Association Convention. March 1960. (Secretary, R.F. Gomme, Room 4508, Parliament Buildings, Queen's Park, Toronto) mimeo. p. 4.

Taylor, Gordon D. *An Evaluation of Non-Urban Recreation and Tourism*. A paper delivered before the British Columbia Resources Conference, 1956. Victoria: B.C. Forest Service. mimeo. p. 26.

. *Physical Facilities for Recreation in British Columbia* ibid. 1958. mimeo. p. 20.

The Nature Conservancy, *Living Museums*. Washington 6, D.C.: 2039 K Street, N.W.

Township of Etobicoke. (Metropolitan Toronto). *Report on Parks and Open Spaces*. The Etobicoke Planning Board, 550 Burnhamthorpe Rd. June 1959. Etobicoke: mimeo. p. 116.

United States National Park Service. *Basic Need for Land*. An address before Columbus Metropolitan Park Board by Conrad Wirth. 1251 E. Broad Street, Columbus, Ohio. mimeo. 1957.

. *Great Lakes Shoreline*. Recreation Area Survey. Washington, D.C.: Department of the Interior. 1959.

. *Resources for a Growing Population*. Recreational Resources. Report of the Secretary of the Interior. Washington: U.S. Government Printing Office, Superintendent of Documents. 1960. p. 10

Vetter, Roy A. *Digest of Laws Relating to Local Parks and Recreation*. National Parks Service. Department of the Interior. U.S. Government Printing Office. Washington. 1941. p. 534.

Whyte, William H. *Conservation Easements*. Urban Land Institute. Bulletin 36. Washington D.C.: 1200 18th Street N.W. 1959.

Wolfe, Roy I. *Recreational Land Use in Ontario Thesis*. Legislative Library, Parliament Buildings, Queen's Park. Toronto. Typescript. 1955.

References

LEGISLATION REFERENCES

Federal
Canada Shipping Act. R.S.C. 1952 C29*, Municipal Grants Act. R.S.C. 1952 C182*, National Capital Act. 1958 C37, National Harbours Board Act. R.S.C. 1952 C187*, National Parks Act. (and Regulations). R.S.C. 1952 C189*, Navigable Waters Protection Act. R.S.C. 1952 C193*, Surplus Crown Assets Act. R.S.C. 1952 C260, Territorial Lands Act. R.S.C. 1952 C263*.

Alberta
City Act. R.S.A. 1955 C42*, County Act. R.S.A. 1955 C64*, Municipal District Act. R.S.A. 1955 C215*, New Towns Act. 1956 C39*, and 1959 C58, Provincial Parks Act. R.S.A. 1955 C249, Public Lands Act. (and Regulations) R.S.A. 1955 C259*, Survey and Expropriations Act. (and Regulations) R.S.A. 1955 C328*, Town and Rural Planning Act. R.S.A. 1955 C337*, Town and Village Act. R.S.A. 1955 C338*.

British Columbia
Department of Recreation and Conservation Act. R.S.B.C. 1960 C110, Land Act. R.S.B.C. 1960 C206, Land Registry Act. R.S.B.C. 1960 C208, Local Services Act. R.S.B.C. 1960 C224, Municipal Act. R.S.B.C. 1960 C225, Public Works Act. 1955 C65 and 1957 C53 Dept of Recn. Act.

Manitoba
The Crown Lands Act. R.S.M. 1954 C57, The Expropriation Act. R.S.M. 1954 C78*, The Municipal Act. R.S.M. 1954 C173*, The Municipal Board Act. 1959(2nd) C41*, The Provincial Parks Act. 1960 C53, The Real Property Act. R.S.M. 1954 C220*, The Town Planning Act. R.S.M. 1954 C267*, The Water Rights Act. R.S.M. 1954 C289, By-laws of the Winnipeg Board of Parks and Recreation.

New Brunswick
Crown Lands Act. R.S.N.B. 1952 C53*, Town Planning Act. R.S.N.B. 1952 C233*.

Newfoundland
The City of Cornerbrook Act. 1958 No. 25*, The Expropriation Act. 1957 No. 42*, The Local Government Act. 1956 No. 52*, The Provincial Parks Act. R.S.N. 1952 No. 9*, The Urban and Rural Planning Act. (and Regulations) 1953 No. 2*.

Nova Scotia
Angling Act. R.S.N.S. 1954 C9, Beaches Protection Act. 1960 C2, Beaches and Foreshore Act. R.S.N.S. 1954 C20, Expropriation Act. R.S.N.S. 1954 C91*, Lands and Forests Act. R.S.N.S. 1954 C145*, Provincial Parks Act. 1959 C7, Water Act. R.S.N.S. 1954 C312*.

Ontario
The Agricultural Societies Act. R.S.O. 1960 C11, The Assessment Act. R.S.O. 1960 C23, The Beach Protection Act. R.S.O. 1960 C31, The Beds of Navigable Waters Act. R.S.O. 1960 C32, The Community Centres Act. R.S.O. 1960 C60, The Conservation Authorities Act. R.S.O. 1960 C62, The Crown Timber Act. R.S.O. 1960 C83, The Ditches and Watercourses Act. R.S.O. 1960 C109, The Forestry Act. R.S.O. 1960 C153, The Highway Improvement Act. R.S.O. 1960 C171, The Lakes and Rivers Improvement Act. R.S.O. 1960 C203, The Local Improvement Act. R.S.O. 1960 C223, The Mining Act. R.S.O. 1960 C241, The Municipal Act. R.S.O. 1960 C249, The Niagara Parks Act. R.S.O. 1960, C262, The Ontario Parks Integration Board Act. R.S.O. 1960 C277, The Ontario-St. Lawrence Development Commission Act. R.S.O. 1960 C279, The Ontario Water Resources Commission Act. R.S.O. 1960 C281, The Parks Assistance Act. R.S.O. 1960 C285, The Planning Act. R.S.O. 1960 C296, The Provincial Parks Act. (and Regulations). R.S.O. 1960 C314, The Public Lands Act. (and Regulations). R.S.O. 1960 C324, The Public Parks Act. R.S.O. 1960 C329, The Railways Act. R.S.O. 1950 C331 S241, The Surveys Act. R.S.O. 1960 C390, The Wilderness Areas Act. R.S.O. 1960 C432.

Bill 120
An Act to make Uniform the Procedure determining the Compensation for the Expropriation,or Injurious Affection of Lands by Public Authorities. 1st Session, 26th Legislature (Ontario), 1960.

Prince Edward Island
The Provincial Parks Act. 1956 C25, The Town Planning Act. R.S.P.E.I. 1951 C163*, The Village Service Act. 1954 C39.

Quebec
Cities and Towns Act. R.S.Q. 1941 C233*, Fish and Game Clubs Act. R.S.Q. 1941 C155*, National Parks Act. R.S.Q. 1941 C156*, Watercourses Act. R.S.Q. 1941 C98*.

Saskatchewan
The City Act. R.S.S. 1953 C137*, The Community Planning Act. R.S.S. 1953 C157*, The Forest Act. 1959 C96*, The Municipal Expropriation Act, R.S.S. 1953 C151*, The Provincial Lands Act R.S.S. 1953 C45*, The Provincial Parks and Protected Areas Act. 1960 C27, The Public Works Act. R.S.S. 1953 C30*, The Regional Parks Act. 1960 C40, The Rural Municipality Act. R.S.S. 1953 C140*, The Town Act. R.S.S. 1953 C138*, The Village Act. R.S.S. 1953 C139*.

*Denotes that Amendments have been made to the Act.

93452—67

Notes and References

[1] The supply of public lands in provinces and municipalities can fluctuate considerably in response to tax delinquency.

[2] Quebec did not send full information on this subject.

[3] In planning Ontario's resource base, an interesting procedure is followed in the northern forest districts. A type of zoning is used, including 10 to 11 land use designations. For example, cottage sites may not be sold on Crown land in a deferred Development Area, a Special Shut Zone or a Wilderness Zone. Public hunting, fishing and tenting, however, are allowed in a Wilderness Zone (not to be confused with a Wilderness Area). Advisory Committees in each forestry district adopt the zoning plans as a guide to administration; the plans have no legal force and can be amended from time to time. All aspects of development are considered and suitable private recreation areas and potential parklands are identified in advance.

[4] Indian lands are private lands; for any public purpose, they must be purchased. One park in Ontario is operated by Indians themselves on their reserve.

[5] Our information for Quebec is incomplete.

[6] National Capital Commission, Sixtieth Annual Report, 1959-60.

[7] Whyte, W.H., in *Securing Open Space for Urban America: Conservation Easements*, Urban Land Institute, Technical Bulletin 36, Washington, D.C., U.S.A., October, 1959.

[8] The following excerpt from *Gifts That Last Forever*, published by the British Columbia government is interesting: "How does one go about donating Park Land to the people of British Columbia? Actually, it is quite simple.

"Gifts have been made in these three ways; (1) as an immediate gift, (2) as a bequest, and (3) as a combination of gift and bequest, permitting the donor to deed the land now, yet retaining life occupancy.

"The Minister then arranges for an examination of the property by offficials of the Parks Branch. If the land is suitable for a Park (obviously, all land is not good for recreational use, just as all land is not suitable for forestry or good for mining or power), a Conveyance to the Province is arranged.

"The Government, of course, will respect any reasonable wishes the donor might have regardling the property, with the exception of commitments that might limit conditions of development and use. But the Government will guarantee that the land will be used for park purposes only, whenever such is the donor's express wish."

[9] The way in which England's National Trust encourages gifts of open space and buildings of historic and architectural interest is this: the value of the property is immediately deducted when the gift is made and is not computed in the valuation of an estate for death duties.

[10] This paper does not deal with the important question of the degree to which provincial authorities direct or encourage local planning activities. Planning provisions used by chartered municipalities have not been studied.

[11] Within the proposed *protected road* zoning regulations for Newfoundland, there are subdivision control provisions; 10 per cent may be required for public use other than streets, and "a strip of land, undeveloped, shall be reserved along the banks of every river, brook or pond in accordance with the Crown Lands Act" which may constitute the area required for public use.

[12] The State of Ohio is a leader in creating a roadside rest system. It hopes to build *rests* every 25 miles on each side of its major routes. These sites are selected promptly after line and grade of the highway have been set and are acquired, not expropriated. The minimum size of site is three to four acres, parking areas are paved and the whole area both fenced and screened with shade trees. Caretakers, not crews, are employed for maintenance.

[13] For a definition of the following terms, as used in this paper, please refer to the glossary, at the end, viz:- access, foreshore, navigable water, riparian rights, shore, waterfront, marina, water park.

[14] Several provinces have reported that studies relating to public water access and shore acquisition are now in progress or about to begin.

British Columbia	A cabinet committee is studying access problems in relation to legislation.
Alberta	The Laws of accretion are under special study.
Ontario	The Public Lands Investigating Committee, 1959. Oceanographic Survey of Lake Ontario under federal-provincial-university sponsorship.
Prince Edward Island	A study of beach reserves, expected in 1961.

[15] From correspondence with the British Columbia Department of Lands and Forests, November 1960.

[16] The results of erosion and accretion, both natural and man-made, are now being seen in relation to access problems. This interdependency is clearly expressed in the 1953 report of the Select Committee of the Ontario Legislature on Lake Levels of the Great Lakes.

The Organization of the Field of Recreation in Canada

E.R. McEwen,
Deputy Head,
Recreation Branch,
Royal Canadian Air Force,
Ottawa.

A wide variety of leisure services are currently provided by the federal, provincial and local governments. These services have grown over the years as specific needs were recognized, such as physical fitness, adult education, parks, camping, etc. In addition, there are over a hundred voluntary agencies organized on a national, provincial and local basis to offer services and facilities.

The leisure activity services provided lack unified administration. At both the federal and provincial levels there are over a dozen different departments and agencies with almost no co-operation among them and services emerge from collections of little independent administratively unrelated empires. The confused administrative approach by the senior governments has inspired a similar multilateral administrative development for recreation in local governments. As a result there is a great deal of overlapping and duplication of effort and further there are many areas of need that remain unsatisfied.

The expanding public service is cutting across the programs traditionally offered by the voluntary agencies and serious overlapping of effort is evident. There is, however, a definite need for voluntary agencies in the recreation field and the organizational structure in Canada should be such that a working partnership can be attained between them and the public agencies. This partnership can be realized only through an understanding of their relative roles.

There is a limit to the number of voluntary organizations that can gain strength and operate efficiently in a community. The voluntary agencies' programs and services are conceived by their respective headquarters at the national or provincial levels and their stereotype activities do not always fit the needs of the community. The shortage of qualified leaders and the need to acquire additional space and facilities are two major problems confronting the movement. A clear-cut organizational structure for recreation in Canada would facilitate improvements in these two fields.

There is an urgent need to draw together the public services at the three government levels so that each provides a cohesive and balanced pattern of services in support of recreation. Fully developed departments devoted exclusively to servicing recreation needs are necessary at the provincial and local levels. An appropriate authority or department is desirable at the national level to give general focus to recreation and assistance to the provinces.

Joint planning and co-operative action among all the public and voluntary agencies could be achieved through the creation of recreation councils at the local, provincial and federal levels. Both the public and voluntary groups would be represented in these bodies.

The Canadian scene is littered with the dry bones of studies and reports which have pointed out recreation needs. For various reasons, the resulting action has been less than what had been hoped for. It has been difficult to get the public to recognize that the problem of leisure needs any special attention. There is, however, strong evidence that thinking has changed markedly in the past few years.

This paper outlines the ways in which Canadian people organize to meet their recreation needs and indicates some of the main weaknesses in the present approach.

The recommendations at the conclusion of the paper deal primarily with the problem of obtaining an acceptable and efficient organizational structure around which the required services can be built.

The following basic assumptions are made in this paper:

(i) Recreation is a need, which should be satisfied to ensure the physical, mental and emotional well-

93452—67½

being of all our citizens, young and old. They are entitled to diversified opportunities for their enjoyment and fulfillment.

(ii) The recreation program must be planned and conducted on a democratic basis. It cannot be mandatory and imposed on the people.

(iii) Recreational needs can be met with maximum efficiency only through a partnership of all government and voluntary agencies operating on the national provincial and local levels.

(iv) In the event of conflicts in resource use public needs should have precedence over private and commercial interests.

1. The Need for Clarification of the Role of Public and Voluntary Agencies.

The rapid growth of public recreation, particularly at the provincial and community levels has cut across or paralleled the programs and services traditionally carried by voluntary agencies. As a result there is confusion, duplication and waste. Perhaps of even greater significance are the serious gaps in the services provided.

The attainment of a broad balanced approach to public recreation requires a close working partnership among the voluntary agencies and with the government organizations involved in the provision of programs and facilities. A clarification of the relative role of public and voluntary agencies is basic to any consideration of administrative organization.

(a) Characteristics of Public and Voluntary Agencies.

To the public agency, recreation is like education; It meets a basic human need in modern society. By comparison, many voluntary agencies use recreation as a means to another end—citizenship training, religion, character building, etc.

The public agency is owned by the people and therefore its services must ultimately satisfy the citizens. Consistent failure to meet needs will lead to corrective action through the democratic process. In short, the public recreation agency is responsible to the citizens of the community and the voluntary agency is primarily responsible to its members. While it is controlled to a degree through the charter it holds under provincial of federal legislation it is difficult for those outside an organization to influence its activities and services. Further, the local membership often exercises only limited influence over operations since in most instances the terms of reference for the voluntary agency are controlled at the headquarters level (provincial or federal).

The ability to service is contioned by access to financial and other resources needed in programming. The publicly supported agency has far greater potential resources than those available to voluntary groups. The public agency is often endowed with the legal authority to acquire land, beach areas, etc. Expropriation powers are often available when such action is necessary. The financial resources of the voluntary agencies, while in some instances extensive, are not quite enough to provide the necessary land buildings. Local governments have tradditionally provided the major recreation areas and facilities such as parks, playgrounds, museums, libraries, etc., while voluntary agencies have taken a large measure of the responsibility for the organizing and conducting of the programs.

The public recreation agency is usually a permanent part of the community. There are certain types of voluntary agencies such as service clubs, which may devote a great deal of attention to recreation needs for a few years and then switch to another worthy or more popular cause.

Recreation programs require a large number of volunteers to serve as leaders, committee members, instructors, coaches, officials, etc. Leadership in leisure activities is in itself recreation for a good many people. Voluntary agencies pursuing a clear-cut and worthy cause usually find it easier to attract volunteer leaders and lay workers than do the public agencies. People tend to expect financial reimbursement when working for a tax-supported body.

The public agency has a responsibility to provide a floor of basic services to reach all parts of the community. In view of this it is often difficult for the public agency to provide special services to meet special needs. Voluntary agencies which are not responsible for community-wide services often move in and satisfy these special needs of groups and individuals. For example, service clubs often establish programs in depressed neighborhoods long before the public recreation agency can get around to it through its slower moving processes.

Private agencies have for the most part been the pioneers and demonstrators in many aspects of recreation and to a large extent public programs have been built on their efforts and experience. It is here, although not exclusively so, that a progressive line of experimentation takes place and provides the life-blood of the recreation movement. The Y's church groups, service clubs, Scouts, Guides, etc. will always fill an important role in this respect. The Y's

consistently employ professional staff of a high standard and much of their work has been accepted as a model of its kind in the public movement.

(b) Pre-Conditions for Achieving An Effective Partnership.

A major concern at this time is to find an effective partnership between the voluntary and public agencies to meet the total leisure needs of the people. This problem is felt at all levels of government but perhaps most acutely in the local communities. While no final and exhaustive statement can be made at this time as to the precise nature of the relative roles of public and voluntary agencies, there are a few guide posts worthy of consideration. It is imperative, however, that both public and voluntary agencies make a deliberate effort to understand one another and that they be ready at all times to co-operate in the interest of the general public.

Private agencies should recognize that the public programs are in the process of expansion and be prepared to adjust their roles as the situation requires. The fact of being first in the field is not valid reason to resist change.

In a situation where an agency is serving the whole community, as for example *Settlement Houses* in congested areas, it is advisable that such an agency be taken over by the public authority, or at least financed by the local government.

On the other hand, public agencies should recognize that they cannot and should not attempt to provide all the leisure services required. The public authority should seek to assist the voluntary agencies in the recreation aspect of their work.

Voluntary groups should be prepared to review their programs and adjust them in the light of community needs. They should bear in mind that programs developed at the provincial or national headquarters may not be what is needed in a particular neighborhood or community.

There is a limit to the number of organizations that can gain strength and operate efficiently in a community. This is particularly true when most of them rely on volunteer leaders, many of whom have had little or no training. Matters often resolve themselves into the situation where a great deal of effort is put into membership drives, which soon fade out when leadership fails. This can leave a feeling of futility and frustration.

Actually there has been very little attention given to the need to establish machinery for joint planning between the public and voluntary agencies.

The Community Programs Branch of the Ontario Department of Education has produced an interesting statement covering the relationship of local recreation commissions to the voluntary organizations of the community. The statement which is based on 15 years experience with the problem, where there is no *blueprint* that can be automatically applied to all communities, recommends to municipal commissions that:

(i) the planning and administration of public recreation areas and facilities so that they can be used effectively by voluntary agencies in the conduct of their program.

(ii) the provision of leadership training services by public agencies. Voluntary agencies can recruit volunteer workers in substantial numbers, but often experience difficulty in training them. Public training services should be open to all agencies conducting leisure activity programs and should include courses for: Group Leadership, Arts and Crafts, Music, Drama, Sports Coaching, etc.

(iii) the provision of technical advice and literature on planning and organization. (1)

2. *The Need to Co-ordinate the Activities of Public Recreation Agencies.*

Recreation services at all three government levels lack unified administration. There is currently a hodge-podge of services with a great deal of overlapping and duplication of effort and expenditure. Services have developed gradually over the last half century on a more or less ad hoc basis. On the basis of expediency, functions have been added to existing departments and agencies as officials gradually become aware of needs. All this effort and expenditure needs to be drawn together somehow and streamlined to provide a balanced service to meet the leisure needs of our people. It is not at all likely that the civil servants will do much more than pay lip service to the need for co-ordination and joint planning since their own status is frequently affected. Political action appears to be the only solution.

The fact that public recreation has been regarded by many as a *frill* rather than as a basic need in the community may be partially responsible for the present situation (2). However, today the need is obvious and the problem of obtaining agreement among the agencies and departments involved for the adjustment of their programs is very real.

(a) The Need at the Federal Level.

Over a dozen federal departments and agencies are

involved in supporting the Canadian recreation movement. There is, however, no agency in the federal government which gives leadership and systematic support to the recreation movement as a whole. Much of the confusion of the provincial and municipal levels arises from the lack of guidance and assistance from the national level (3).

The problem would be eased if the federal government would co-ordinate what it is now doing to support Canadian recreation. To this end it should establish effective working relationships among such agencies as the National Parks Branch, the recreation branches of the Armed Forces, the CBC, The Canada Council and the youth programs of the department of Agriculture.

There have been several attempts by various national recreation groups to co-ordinate the activities of voluntary organizations at the national and provincial levels and to tie in more closely with public agencies. Unfortunately the efforts to date have not enjoyed much success.

In 1950, an attempt was made to establish a Canadian Recreation Congress to provide an annual conference service for the recreation movement. The Congress obtained a charter, but failed to raise the necessary money to operate.

The Canadian Welfare Council's Recreation Division has been attempting to overcome this problem but their success has been limited. The recreation leaders contend that recreation is not an aspect of welfare but a field of its own. Resistance to co-ordination and joint planning has arisen due to the carry over of agency competition to the problem. In other-words, who has the authority to co-ordinate whom? To some degree lack of success can be attributed to insufficient financial investment in this work, due to the lack of conviction that this task is a responsibility of the Council as it is presently constituted.

The Joint Planning Commission of the Canadian Association for Adult Education has had a good measure of success in providing a clearing house and planning service for adult education activities of public and voluntary agencies operating on the national level. The work of this body is limited by lack of finances and its terms of reference which restrict its scope so as to include only a portion of the recreation field.

The Parks and Recreation Association of Canada, established in 1946 has been attempting to meet this need. It sponsors annual conferences on park and recreation matters. It has not been able to meet the need for a number of reasons. Financial resources are inadequate. Membership is largely composed of municipal park officials and hence the organization lacks the broad representation required. While its terms of reference are comprehensive its actual work is largely park and facility oriented.

(b) The Need at the Provincial Level.

Over the years each of the provincial governments has built up a wide variety of programs and facilities for public leisure activities. While these services reveal a certain similarity of purpose there is great divergence in the pattern, method and emphasis. Because insufficient attention has been given to co-ordination there is serious overlapping and duplication of effort.

The departments controlling recreation space facilities and areas are not working in close partnership with the departments and branches responsible for programs. Provincial parks, regional parks and municipal parks are in many instances planned and established without the involvement of the community program branches of the government and other related agencies which can and should use these costly facilities in their programming.

Provincial governments provide considerable assistance to community recreation. This assistance is rendered through a wide variety of unrelated agencies which endeavor to meet the demands of the municipalities for such diverse items as parks, museums, etc., which are not presented as part of a comprehensive and balanced program. Provincial governments have attempted to meet these needs on an ad hoc basis by adding functions to existing departments. This un-co-ordinated approach by several agencies contributes to the administrative confusion at the local level. Each provincial agency, because of its frame of reference, brings to the communities a partial point of view (parks, adult education, physical fitness, libraries, etc.). Since it is necessary to comply with provincial regulations in order to qualify for grants and other forms of assistance the municipalities cannot be expected to resolve the problem alone.

This situation results in a great waste of effort by the provincial governments and it fosters similar waste and confusion at the local level. A large amount of the time of the provincial field staff is spent in explaining confusion that need not exist. Numerous pamphlets and interpretative literature are produced annually trying to make sense out of nonsense. While this situation is the result of a slow process of evolution and it is understandable that some

departments are reluctant to give up or modify a program or service that has taken years to establish, some co-ordinated approach is essential.

Efforts have been made in some provinces to achieve a degree of co-ordination in provincial department activities. The Province of Nova Scotia has two interdepartmental committees. One is concerned with parks, facilities, space, etc., the other with program services to local governments and agencies. Newfoundland has an interagency type of committee covering activities in the field of adult education and community leadership. A large proportion of Alberta's leisure programs are grouped in the Cultural Activities Branch under the Provincial Secretary. Ontario has established a Parks Integration Board to co-ordinate the park developments by various provincial government departments such as Lands and Forests, Conservation Branch of the Department of Planning and Development, the Niagara Parks Commission, etc. (4)

Some feel that a much better service could be offered if all provincial government agencies were administered under one department. The Province of British Columbia has established a Department of Recreation and Conservation, which consolidates a large part of the government services for recreation.

A comprehensive and balanced provincial recreation service requires close working relationship between the government and voluntary agencies. To date little attention has been given to this important matter.

There are well over 100 voluntary agencies, associations and societies provincially organized that provide guidance and support for leisure activities conducted by their local affiliates. The lack of co-ordination and joint planning among these agencies results in serious overlapping and confusion in the communities.

It is generally felt that a provincial recreation council representative of both the public and voluntary agencies could provide a clearing house and joint planning function that would ease this problem. Such a council has been recently established in New Brunswick.

(c) The Need at the Municipal Level.

On the local level the administrative authority for recreation is shared by parks boards, recreation commissions, library boards, etc. The public service is conducted by these agencies on a unilateral basis. It is at this level of government that the problem is possibly most acute and the handicap the greatest.

Even where there is a designated administrative structure in the local government, such as a recreation commission, this body often covers only a part of the local public recreation services. It is not uncommon to find a parks board operating independently of the recreation commission where the two exist. Library boards, art galleries, museums, exhibition boards, etc. in most instances have no formal tie with the recreation administration, although they contribute significantly to the leisure time needs of the people.

The consensus of opinion is that all the public recreation services need to be drawn together to make one cohesive public service devoted exclusively to serving the recreation needs of the community under the structure of a department or a comission, staffed by qualified recreation leaders. It is also advocated that this agency be *program* oriented and have control of all the public recreation facilities such as parks, playgrounds, playfields, municipal golf courses, beaches and the like.

Suitable structure is also required for co-ordination and integration of the total public and the total voluntary programs. Joint planning and co-operative action on the local level has been difficult because of the lack of such co-operation at the provincial and national levels as noted. The unilateral approaches from the two senior levels have stimulated a like response in the communities.

The format for joint planning and co-operation between the public and voluntary agencies will vary considerably with the size of the community:

(i) *Small Communities up to 25,000*
Here the need could be met through conducting a planning type of conference twice a year where all the agencies can discuss their role in the total community program;

(ii) *Medium Sized Community 25,000 to 150,000*
Here an advisory council made up of representatives of the operating agencies and organizations could be established;

(iii) *Larger Communities 150,000 and Up*
Here a well constructed recreation planning council appears to be required composed of representatives of public, voluntary, industrial recreation bodies.

Throughout Canada it now appears to be a well established principle that municipal public recreation departments should do what they can to strengthen the programs of the voluntary agencies as well as extend their own to fill the gaps. The focus now appears to be on mobilizing all resources, facilities, areas, and leadership to meet the leisure needs.

3. The Need for Qualified Leadership.

The provision of adequately trained personnel for recreation is a continuing problem. Some professional training is now given at the universities. Ten of them offer degree courses, which are principally oriented to physical education. A number of provincial and municipal agencies provide in-service training schemes for their personnel and in some instances this service is available to voluntary agencies.

The problem of leadership training is complicated by the absence of a consistent pattern for recreation administration in Canada or the United States. When the administrative pattern for public recreation has been more firmly established in Canada, it will be easier to approach the problem of recruiting and training the required professional leadership. Until such time it will be necessary to use a flexible training scheme to meet the needs of the diversified administrative pattern.

The recreation movement has been seriously hampered by lack of clear-cut information to local leaders on how to go about organizing recreation for all age groups in their community. Three deficiencies in the present situation hamper progress: a partial point of view, partial services and partial organization.

A partial point of view is a serious handicap. Typically, information and guidance on recreation matters given communities carry both the values and limitations of specialization. The emphasis may be associated with physical fitness, adult education, *welfare* narrowly conceived, or with a restricted cultural area such as music, art, drama. Technical recreation services that are available in such fields are organized camping, parks and playgrounds planning, arts and crafts, etc. are also partial being neither universally available nor effective. Closely related to partial services and probably responsible for such is the incomplete organization of technical and planning services at the provincial and federal levels.

Before the problem of training leaders can be solved it is necessary to have answers to the following questions:

(a) Is recreation a profession in its own right? Will recreation take its place as a public service alongside such established services as education, health and welfare?

(b) Is recreation an aspect of education? Can teacher-training be extended to meet the need?

(c) Is recreation a part of welfare services? Can social work training be adjusted to meet the need?

After the administration problem has been resolved, and the foregoing questions answered, there are still a number of more detailed matters to be considered:

(a) What are the main job classifications in the field of public recreation and the duties associated with each?

(b) What knowledge, skill and personal qualities are required?

(c) What training service of a professional nature is required to ensure that the leadership for the field is qualified to meet the duties and responsibilities?

(d) How much of the recreation leadership is to be carried by:

(i) full-time professional workers?

(ii) part-time workers?

(iii) volunteers?

4. The Need for Adequate Facilities.

Other papers in this series are devoted to a consideration of the provision of resources for recreation and tourism. However, there are one or two aspects of this problem that are closely related to the main theme of this paper and therefore deserve special mention.

The problem of open space for recreation will require co-operative planning and action by the governments on three levels. There is need for a closer working relationship between the physical planners, the program planners and citizen groups, in order to ensure the space and facilities provided are in line with the needs.

Before comprehensive planning can begin it will be necessary to obtain agreement on the principles and standards upon which planning is to be based. This will involve considerable systematic joint study and research by governments and voluntary agencies concerned. At the present time there is no adequate provision for research of this type.

There seems to be a general lack of knowledge among city planners and administrators as to what open space should be provided in the new subdivisions for recreation purposes. Physical planners and program planners have tended to work independently. The space that is provided is often of little practical use for leisure time activities. Some of our cities have attempted to adapt standards advocated by the National Recreation Association of America and similar non-Canadian bodies. However, there has been very little Canadian research on this problem and hence there are no solid accepted Canadian standards to serve as guide posts.

The encouraging sign is the trend to design public buildings and areas on a multi-purpose basis. Many schools are now planned to serve as day schools and also as recreation and adult education centers. In so-

me instances fairgrounds are designed to serve both exhibition and recreational purposes. Further research in design and layout would facilitate this desirable trend.

5. Some Recommendations for the Improvement of the Administrative Structure.

Before considering specific recommendations, it is necessary to note a few key points and factors relevant to structuring the organizational pattern for recreation.

Fundamentally, leisure belongs to the people and what they do with it is their concern. Recreation programs and their administrative apparatus must, therefore, be primarily structured to meet the prevailing needs and interests of the people.

Experience has shown that recreation programs and support services *laid out* cafeteria style by benevolent agencies and governments without reference to public preferences are rarely received with enthusiasm. The individual wants an opportunity to pursue activities that meet his particular needs and desires. Experience has not shown that he wants a share in the planning, organizing and conducting of the activity. Further, when an individual engages in an activity which meets his real needs he usually pursues it with vigor and enthusiasm and is often ready to invest both time and money to aid the cause.

In this respect local governments have a major role, since it is on this level that most of the needs are discovered and satisfied. There are, however, certain recreation needs which are satisfied on a regional and national basis. Here again however the local governments have a contribution to make.

The responsibility for recreation should be shared by the individual, parents, community institutions, and the governments.

The *individual* has the responsibility to select and pursue leisure activities that lead to the development of his latent abilities, and at the same time help and encourage others to do the same. The *parents* have the responsibility of guiding and encouraging the children to develop creative and wholesome attitudes toward use of leisure. They must give children a sense of values and desire for personal growth and fulfilment through the constructive use of leisure.

The *local government* has the responsibility for providing a floor of services and facilities to assure that all members of the community have opportunities for healthful activities of their choice. *Schools and other community* institutions have the responsibility of providing the knowledge and basic skills to enable the pursuit of leisure interest and also provide opportunities for worthwhile activity.

The *senior governments* have the responsibility of supporting the local governments in meeting the needs of the people and the provision on a direct basis of the facilities and services which cannot be provided by local government such as regional, provincial and national parks services.

Finally it must be noted that the keystone in the structure is an efficient and acceptable partnership of the public and voluntary agencies, commercial recreation interests, and the citizens themselves.

At the national level it is recommended that:

1. A recreation authority Commission or Crown Corporation be established within the federal government. The principal function of this agency should be to assist the provinces in this area of work and provide those other services which can only be rendered on the national level.

The proposed recreation authority would be structured and staffed to:

(a) Administer and generally co-ordinate the services currently provided by:
  (i) National Parks Branch,
  (ii) Recreation and fitness services of the Department of National Health and Welfare,
  (iii) The National Museum and Gallery,
  (iv) The Tourist Bureau,
  (v) Youth Programs of the Department of Agriculture,
  (vi) Other agencies and services designed primarily to serve leisure need.

(b) Provide grants to the provinces, sufficient to assure adequate distribution of recreation areas, facilities, leadership, program and services for all Canadians.

(c) Establish standards for leadership, areas, facilities, etc.

(d) Conduct research required on problems confronted by the recreation movement.

(e) Provide regular and systematic information service covering all aspects of recreation through bulletins and technical publications.

(f) Provide a competent professional staff to provide consultative services to the provinces when requested.

(g) Provide technical help and guidance when requested by other government agencies operating recreation programs such as the Armed Forces, C.B.C., Penitentiary Commission, etc.

2. A *recreation council* be established at the national level, composed of appropriate representation from public and voluntary agencies providing nation-wide services. For efficiency of operation appropriate standing committees should be established to cover the various segments of specialized interests.

The purpose of the council would be to provide:

(a) A general clearing house service for the recreation movement.

(b) To serve as a medium for joint planning and co-operative action among all the agencies, public and voluntary.

(c) To evaluate current programs and services and make recommendations concerning new services required.

(d) To serve as a national forum for the discussion and consideration of matters related to the leisure needs of Canadians.

This council should be sponsored and financed by the federal recreation authority.

At the provincial level it is recommended that:

1. A *provincial recreation department* or similar type of agency be established in each of the provinces, comparable in character to that proposed for the national level. Its principal functions would be:

(a) Consolidate and administer the recreation services now being provided by the provincial government.

(b) Provide appropriate grants to aid local and regional governments in financing their programs.

(c) Provide training and certification services for recreation leadership.

(d) Provide consultation and field service for local government.

(e) Provide information and technical advice to local recreation commissions.

(f) Develop standards for all phases of recreation, areas facilities, programs, etc.

(g) Provide assistance and encouragement to voluntary agencies contributing recreation services in the province.

(h) And provide such other services as are required to support local governments in meeting the leisure need of communities.

2. A *recreation council* be established in each of the provinces, composed of representatives of voluntary and of the provincial government agencies. Like its counterpart proposed for the national level the council should have standing committees for each of the segments of specialized interests, e.g.

(i) Standing committee for sports; each provincial sports governing body would be represented on this committee.

(ii) Standing committee of youth serving agencies.

(iii) Standing committee for cultural activities, etc.

The council would provide:

(a) Clearing house service for all recreation agencies operating on its provincial level.

(b) Medium of joint planning and co-operative action, as required.

(c) Continuing attention to ways and means of improving recreation services to the people of the province.

(d) Recommendations to its counterpart on the national level re assistance required by the province.

Note: The Joint Planning Council of New Brunswick serves a similar purpose.

At the local level it is recommended that:

1. A *recreation department* or comparable authority be established by the local governments to have the single purpose of assuring adequate opportunity for all members of the community for leisure activities in keeping with their interests and needs.

This department should have control of both physical resources such as public parks, sport fields, beaches, pools, arenas, etc. and also be responsible for the program and support services.

The functions should include:

(a) The planning and organizing of constructive programs and services on a year-round basis available to all members of the community.

(b) Assist community groups and organizations working to meet leisure needs through:

(i) Helping in developing leaders.

(ii) Offering consultative and advisory services.

(iii) Helping groups to obtain suitable resources, facilities and equipment, etc.

(iv) Encouraging joint planning and co-operation among all the agencies.

2. An *advisory council* or committee be established and associated with the public department. This body would be composed of representatives from all the major agencies providing recreation services in the community.

This council would provide a general clearing house service for all the agencies – public, voluntary, industrial, etc. – and seek to promote joint planning and co-operative action using all available resources in meeting the over-all recreation needs of the commity. The actual size and structure of the council would vary from community to community, as indicated earlier in this paper.

Notes and References

[1] Comments on Municipal Recreation, Ontario Department of Education.

[2] This is perhaps illustrated by the fact that, when municipal budgets are cut back, it is the recreation program and services that suffer first. On the other hand an ever increasing number of citizens and leaders contend that recreation like health, welfare and education are basic requirements in modern life, particularly in light of the steady increase of leisure time, increased income, etc.

[3] It might be noted that the problems of co-ordination and consolidation of the public recreation services have prevailed in the U.S.A. for many years. On the federal level an Inter-agency Committee on Recreation was established in 1946, which involved the National Park Services of the Department of Interior, the Extension Service of the Department of Agriculture, the Office of Education of the Federal Security Agency, the Veterans Administration, The Cildrens Bureau of the Federal Security Agency, The Army Corps of Engineers, Federal Public Housing Authority.

[4] Interagency recreation committees have been established in a number of the states in the U.S.A. Their functions are similar to those of their counterpart at the federal level: discussion of plans for new projects and services, study and development of future plans and projects, discovery of gaps in services and joint consideration of matters related to recreation.

Experience here has clearly shown that the Interagency Committee is not the answer to the problem. At best it is a stop gap. The services of the agencies are not being effectively coordinated nor is joint planning being achieved to the required degree. There is a strong movement now in the U.S.A. supporting the establishment of a Federal Recreation Authority and similar authorities at the State level.

Bibliography

Brightbill, Charles K. and Harold D. Meyer. *Recreation Text and Readings*. Prentice-Hall, Inc. New York. 1953. pp. 541.

Butler, George D. *Introduction to Community Recreation*. McGraw-Hill Book Co. New York. 1940. pp. 547.

Butler, George D. *Recreation Areas – Their Design and Equipment*. A. S. Barnes and Company. New York. 1947.

California Committee on Planning for Recreation, Park Areas and Facilities. *Guide for Planning Recreation Parks in California*. California State Documents Section. Printing Division. Sacramento. 1956. pp. 77.

Canadian Association for Adult Education. *Adult Education in Canada*. University of Toronto Press and Les Presses Universitaires Laval. 1960. pp. 80. (French and English)

Canadian Youth Commission. *Youth and Recreation*. The Ryerson Press. Toronto. May 1946. pp. 150.

Community Programs Branch, Ontario Department of Education. *Comments on Municipal Recreation*. Ontario Department of Education. Toronto. 1957. pp. 100.

Community Programs Branch, Ontario Department of Education. *Notes for Community Leaders*. Ontario Department of Education. 1958. pp. 141.

Community Programs Branch, Ontario Department of Education. *Notes on Legislation Affecting Recreation in Ontario*. Ontario Department of Education. Revised 1958. pp. 59

Doell, Charles E. and Gerald B. Fitzgerald. *A Brief History of Parks and Recreation in the United States*. The Athletic Institute. Chicago, Ill. 1954. pp. 128.

Dominion Bureau of Statistics. *Survey of Adult Education*. The Queen's Printer and Controller of Stationery, Ottawa. 1960. pp. 71. (French and English)

Dominion Bureau of Statistics. *Survey of Libraries – Part I Public Libraries*. The Queen's Printer and Controller of Stationery. Ottawa. 1958. pp. 56 (French and English)

Guthe, Carl E. and Grace M. Guthe. *The Canadian Meseum Movement*. The Canadian Museums Association. Toronto. Multilith. 1958. pp. 47.

Hutchinson, John L. *Principles of Recreation*. The Roland Press Company. New York. 1951. pp. 310.

International City Managers Association. *Municipal Recreation Administration*. International City Managers Association, Fourth Edition. 1960. pp. 407.

Kaasa, W.H. *Co-erdinator's Report, Cultural Activities Branch*, Alberta Department of Provincial Secretary. Edmonton. Mimeograph. 1959. pp. 70.

Kidd, J.R. *Adult Education in the Canadian Universities*. Canadian Association for Adult Education. Toronto. Multilith. 1956. pp. 130.

Manitoba Committee on Physical Education and Recreation. *Physical*

Education and Recreation in Manitoba. Manitoba Department of Education. Winnipeg. 1958.

Meyer, Harold D. and Charles K. Brightbill. *Community Recreation, A Guide to Its Organization and Administration.* D.C. Heath and Company. Boston. 1948. pp. 704.

National Workshop. *Planning Facilities for Health, Physical Education and Recreation.* The Athletic Institute, Inc. Chicago. 1956. pp. 154.

Neumeyer, Martin H. and Esther S. Neumeyer. *Leisure and Recreation.* A. S. Barnes and Company Incorporated. New York. 1949. pp. 411.

Physical Fitness Division, Department of National Health and Welfare. *National Survey of Recreation in Canadian Communities.* Queen's Printer and Controller of Stationery. Ottawa. Mimeo. 1951. pp. 40.

Recreation Branch, Royal Canadian Air Force. *A Guide to Recreation Services in Canada.* Royal Canadian Air Force. Ottawa. Mimeo. 1960. pp. 30.

Recreation Division Canadian Welfare Council. *Recreation in Canada 1948.* Canadian Welfare Council. Ottawa. 1948. pp. 28.

Recreation Division, Canadian Welfare Council. *Recreation and Leisure Time Service in Canada.* Canadian Welfare Council. Ottawa. 1936. pp. 78.

Research Division, Department of National Health and Welfare. *Activities of the Federal Government Related to Recreation.* Department of National Health and Welfare. Ottawa. Mimeo. February 1955. pp. 58.

Royal Commission on National Development in the Arts, Letters and Sciences. *Report of the Royal Commission on National Development in the Arts, Letters and Sciences.* Queen's Printer and Controller of Stationery. Ottawa. 1951. pp. 517.

Tuttle, George, *Youth Organizations in Canada.* The Ryerson Press. Toronto. May 1946. pp. 110.

The Hierarchy of Government and Public Agencies in Park Development

Eric Hardy
and
Frank J. McGilly,
of the
Citizens Research Institute
of Canada, Toronto, Ontario.

In Canada, parks and recreation are administered at all three levels of government – federal, provincial and municipal. Great difficulties of administration arise from the fact that there is no clear-cut distribution of parks and recreation functions among the three.

The national parks system finds itself carrying out provincial and regional park functions in some provinces, and in others doing very little at all. The internal administrative difficulties of the national parks are made much worse by the irregularity of their functions.

Municipal parks are generally administered either by regular municipal departments, responsible to the elected Council, or by relatively independent boards such as the Boards of Parks Management *erected in some Ontario municipalities. Municipalities face grave financial problems with respect to park land acquisition, but more basic is the question of the attitude municipalities have toward their recreation responsibilities. Also, municipalities are subject to provincial control and must learn to live with whatever administrative and financial conditions provinces impose upon them.*

Regional parks, requiring as they do the participation of the province and one or more municipalities, pose the most complex administrative problems and also are probably the greatest area of unmet need in the parks field. Saskatchewan and Ontario have recent legislation governing regional parks, both requiring municipal initiative. One fairly successful and economical type is the regional park that can be developed in a water conservation area. While admirable, such parks are limited as to use and cannot be looked to as the final solution of the regional parks problem.

Provincial parks tend to be administered through departmental branches (Ontario's system is described at length), but British Columbia recently created a Department of Recreation and Conservation. The provincial parks systems, however administered, must be given clearer definitions of their functions especially since they face both ways in their inter-governmental relationships: to the federal government and to the municipalities.

The enthusiasm and generosity of private agencies have been of vital importance to parks development. Inevitably, it becomes necessary to try to fit private efforts in with public programs. Also, there is plenty of scope for commercial recreational operations. If big public parks monopolize some recreational functions, they also open up other possibilities to enterprising individuals.

The parks and recreation function is only one aspect of government in which institutions have lagged behind the movement of society. Certain recommendations are advanced that relate to government in general and to parks and recreation in particular.

(1) Functions appropriate to each level of government must be defined with clarity and consistency.

(2) Administrative co-ordination among government recreation agencies must be a conscious goal.

(3) To spare the public purse, functional co-ordination of recreation with other allied programs (e.g. conservation) should be exploited to the full.

(4) More and better use of the art and technique of planning *should be applied to the provision of recreation facilities.*

(5) Parks and recreation programs should be made the clear responsibility of the elected representatives of the people through the customary departmental system of organization of government.

(6) If institutional amendments are needed - e.g., lengthening the terms in office of municipal councillors - to bring about better handling of public business, they should be made.

(7) All regional functions, not only parks and recreation, stand in need of more effective administration; the answer is the setting up of a second-tier regional *municipality, with elected representatives governing matters of regional concern.*

Canadians are brought up to believe that Canada is a country of "vast untapped natural resources". It may come as a shock to some of us that our natural resources are not uniformly vast and, in particular, that we are in danger of running short of *space*, of all things; but in terms of land adaptable for recreational purposes, the fact is that our supply of space is not unlimited, and in certain places the dwindling supply is inadequate to meet the burgeoning demand.

The people of New York State recently approved by referendum a bond issue of $75 million largely for acquisition of land for recreational purposes. Much of the money is to be devoted to the restoration to wilderness state of some areas partially developed by private parties as hunting and fishing club preserves, etc. The American people take just pride in their laborious 300-year struggle to conquer the wilderness; in 1961 we see them willingly spending vast sums to get the wilderness back. There are lessons to be learned from this, among them the realization that the wilderness of Wyoming or Colorado is of limited use to the average resident of Brooklyn or Syracuse.

Hence the necessity for aggressive, forward-looking policies and for careful administration, assuming that the Canadian community *wants* recreation park facilities and is prepared to pay the price. It has to be assumed that a reasonable attitude toward recreation needs exists at the various governmental levels. Discussion of *administration* assumes the existence of some substantive *policy*.

The first questions to be settled are: What are the various types of recreational parks required by an urbanized nation? Can these be assigned with any show of reason among each of the three levels of government? Is it possible to say which functions should be undertaken respectively by municipal, provincial and federal authorities? These are basically questions pertaining to the need for administrative co-ordination and its relationship to the desirability and possibility of co-ordination along functional lines.

The great stumbling block most feared by promoters of public recreation parks is the frightening expense of land acquisition. Admitting that land not acquired today will be lost forever or will be more expensive tomorrow, it cannot be denied that the cost of land is frequently high enough to give pause even to the enthusiast. This being the case, the public interest demands imperatively that every opportunity be seized to co-ordinate conservation and development of forest, water and soil resources with the satisfaction of recreational needs. The basic problem question is *how* to achieve the necessary *administrative* co-ordination within and between all levels of government to meet the challenges posed by recreational needs. In this paper we consider federal, provincial, regional (including conservation authority) and local municipal parks. There exist also county parks and other joint intermunicipal parks. It is simple to assert that the overall system should be such that services provided are complementary to the greatest possible extent; the question remains one of administrative organization and practices (assuming consistent policies).

While the objective of this paper is to consider these questions as they pertain to the whole country, most of the information is illustrative rather than comprehensive and relates to Ontario and other provinces where the problems and experience appear most relevant. Since it has been deemed advisable to devote most attention to areas of administration where the more complex difficulties exist, the federal parks system is given only a very brief treatment.

I. *Parks and Recreation Administration in Canada.*

(i) *National Parks.*

Since 1885 when the first national park was established to protect the mineral hot springs around what we know as Banff, 18 areas totaling more than 29,000 square miles have been taken into the federal system. The latest such park is *Terra Nova* in Newfoundland. Of the 29,000 square miles, 17,300 are in one area, *Wood Buffalo Park* in northern Alberta and the Northwest Territories.

The first national parks were created from lands belonging to the federal government, chiefly in the west. More recently national parks have tended to be developed in suitable areas made available by the provinces. The impression is freely given that the federal government is unlikely to develop a national park without a provincial invitation. One observes that the Province of Quebec, which has extraordinarily large park reserves, has no national park, and the Province of Ontario, which itself entered the field early with Algonquin Park in 1893, has only three, all relatively small. The upshot of this haphazard development is that at the present time national parks are being called on to perform functions for which they were not intended.

Under the National Parks Act, administration is carried out under authority of the Minister of Northern Affairs and National Resources by the National Parks Service. The Service gets advice from the Forestry Branch of the Department and from the Canadian Wildlife Service, and has engineering work done usually by the Department's Engineering Services Division, sometimes by the Department of Public Works. The key functionary in the administration of the park system proper is the Resident Superintendent, who with his staff is responsible for virtually the entire operation of his park, its animal and vegetable population, its human residents and visitors.

There is a need for a clarification of the role of the National Parks Service in the hierarchy of responsibility for public park development. The problems of the National Parks Service are really problems of administration and government organization as much as problems of technique. The irregular distribution of national parks among the provinces suggests that there is no clear division of responsibility for parks between the federal and provincial levels. Without such a clear division of responsibility, there cannot be smooth co-ordination of national parks with essential supporting services provided by provinces, nor can the public be assured of effective consideration of the other areas of public interest that are associated with parks: conservation, transportation, regional development.

Basic questions come to the fore. Should certain types of large-area park be administered solely by the federal authorities? If so, what kind of park functions ought to be left to the provinces? Is it a good thing for the federal parks program to be geared to the necessity to *fill gaps*, where made welcome to do so? Is one level of government abrogating its responsibility? Should the federal function be, perhaps, more a matter of leadership and service rather than of actual operation? It will be found that questions akin to these arise with respect to parks operations at all government levels — questions of apportionment of responsibilities, and questions of intergovernmental co-operation to ensure that maximum use is made of the parks that are developed, and to eliminate costly conflicts between parks functions and related government programs. Answers are suggested to only a few of these questions in this paper; most of the questions are left open as matter for discussion.

(ii) *Municipal Parks.*

Any attempt to summarize municipal parks administration in Canada in a factual manner would lose itself in a maze of details. In the circumstances, perhaps the best approach is a series of questions:

To what extent do municipalities recognize a need for planned parks development? Where does recreation stand in the scale of priorities of municipalities?

Granted a positive attitude towards the provision of parks, do our municipalities concede any need for specialized administration of parks?

Does the fact that municipalities rely heavily on property taxation for their revenues (Quebec's, Newfoundland's, and, to a degree, New Brunswick's rather less so than the other provinces') impose a limitation on the extent to which they can rationally spend money on recreation? Is this the real deterrent, or is it just their over-all difficulties of revenue-raising?

The advice of experts, intended for both municipalities and provinces, frequently is to grab as much park-type land as possible as soon as possible, because no matter how expensive it is now, it is going to be more expensive later. Presuming the validity of this argument, how many municipalities can afford this kind of saving?

Certain problems that arise in municipal parks administration in Ontario may provide a focus for discussion.

A municipal council in Ontario may choose to set up a Board of Parks Management to operate its parks, or may choose to accept the responsibility for parks itself. The Boards of Parks Management, which have a fair degree of independence vis-a-vis their municipal councils, are governed by the Public Parks Act.

This Act provides machinery for municipalities which prefer to keep parks administration at arms' length from the control of Council, to take parks *out* of politics, as it is sometimes put. Land acquired by a non-elective board might be considered immune from the elected council's presumed propensity to surren-

der long-range benefits for immediate advantages. But this viewpoint presupposes that the council will name to a parks board people who are more inclined than councillors themselves to acquire land in the proper amounts and locations for continuing park purposes. May it not be that the *buffer* idea of the appointed parks board represents an approach not sufficiently positive to stand up to today's growing requirements?

The Public Parks Act, it should be noted, imposes severe limitations on Boards of Parks Management. First, they must run their parks system each year on expenditures (including principal and interest payments on debentures) that represent not more than one mill on the dollar of local assessment; second, they are subjected to a total acreage limitation – e.g. 2,000 acres for a city not less than 100,000 population; 500 acres for a township. To express urban park acreage needs in terms of a direct numerical relation with population is a futile exercise; estimation of space required depends on analysis of many other factors besides population. Purely for illustrative purposes, however, reference can be made to one *rule of thumb* which says that an urban area ought to have seven acres of parks for every 1,000 inhabitants; by this standard, no city of over 300,000 population can possibly be adequately provided for under the Public Parks Act.

In fact, not many of Ontario's cities choose to operate under the Public Parks Act, preferring to place parks administration more directly under the control of the elected council.

It must never be forgotten that the municipalities are subject to whatever controls the provinces choose to exercise, administrative as well as financial. If the province places responsibility for different aspects of parks and recreation in the hands of different department and agencies, the municipalities have no recourse but to deal with all such departments and agencies. For parks and recreation purposes, an Ontario municipality will or may come into contact with:

the Department of Municipal Affairs;

the Department of Planning and Development;

the Horticultural Societies Branch of the Department of Agriculture, if it hopes to erect a community centre as part of a park and to receive a statutory grant therefore;

the Community Programs Branch of the Department of Education, if it wants assistance with a community recreation program:

the Ontario Parks Integration Board (a special body made up of the Chairman or Vice-Chairman of the Ontario-St. Lawrence Development Commission, the Chairman of the Niagara Parks Commission, and three Cabinet Ministers), if the municipality is interested in a parks project outside its own boundaries;

the Ontario Municipal Board, for debenture approvals, for parks as for all other purposes.

(iii) *Regional Parks.*

The part of the parks system in which the problems of administration are most acute is the part that falls between the parks that are strictly local, which by their nature are accommodated within municipal limits, and those that are large-scale provincial or federal parks in vicinities free from immediate heavy urban pressures. It may be contended that present needs are greatest and most pressing, while the range of possibilities for action is most limited and is most rapidly diminishing, in parks programs designed to serve the outdoors recreation demands of urban regions. The administrative problem in this category of parks has two prongs: the government of a province is reluctant to commit itself too heavily for the advantage of only a part of its people; the municipality is characteristically short of money, limited (by the province) in its borrowing, and cautious about expenditures on areas outside its borders.

The most striking thing about the evolution of our parks system in Canada is the relatively recent dates of the important provincial legislation on the provision of parks in urbanized regions, e.g., in B.C., 1957; in Saskatchewan, 1960; in Ontario, 1954, 1957 and 1960.

This alone would suggest that active awareness of recreation needs of this type has had comparatively late growth in Canada. Further evidence is readily forthcoming; in the heavily urban southern regions of Ontario, designated by the province's Department of Lands and Forests as the southeastern and southwestern regions, the number of provincial parks in active operation in 1954 was only three and has increased to 28 today. In Saskatchewan, a province few Canadians would think of as being pressed for space, provincial parks development dates, for all practical purposes, from the appointment in 1957 of Mr. Wm. M. Baker to study parks needs and facilities in Saskatchewan.

One immediately obvious direction in which the province might move to help meet the outdoor recreation park needs of a given urban area is to assist the affected municipalities in the creation and development of such a park somewhere in their vicinity. This is now possible in Saskatchewan under the Regional Parks Act (1960) and in Ontario under the Parks As-

sistance Act (1960). In both cases, the province will assist a municipality or group of municipalities with generous contributions towards capital outlays required at the outset. Of course, a municipality that is hard put to satisfy its needs, including local parks, acquisition for which is most expensive, may be unwilling to contribute very heavily to a regional park. In Ontario's case, the Parks Assistance Act declares that to be approved for assistance a park must *complement* the Provincial Parks system. The regulations specify that the parks must have picnic and camping facilities, must exact admission and service charges not less than those of provincial parks and must be fully maintained by the municipality.

Perhaps it would be parochial for a municipality to argue that the Parks Assistance Act is a scheme whereby the municipalities can be made to help the provincial parks, rather than the reverse. Parochial or not, this view is one that the writers have heard expressed. The defence is that the parks confer a local benefit, chiefly, and ought therefore to be paid for in large part locally.

Most of the applications received in this first year of the Parks Assistance Act's life have reportedly come from rural and small urban communities. Commonly the applications envisage the conversion of an existing camp-site or trailer camp into a park that meets the requirements of the Act and its regulations.

This Act is administered by the Department of Planning and Development; but the Department is obliged to submit an application of which it approves to the Ontario Parks Integration Board.

The regulations promulgated under the Saskatchewan Regional Parks Act are a little more permissive as to park uses than those under the Ontario Parks Assistance Act. The Saskatchewan parks may include sports grounds, specifically including golf courses. Also, there is no compulsion on the Regional Park Authority to charge fees, although it may do so, having applied to the Minister of Natural Resources for approval. Possible competition with provincial or national parks is ruled out by the fact that the Minister is unlikely to approve the placing of a regional park in a location where it would so compete. The object of the Act is stated with a directness refreshing in a public statute: ideally, everyone in Saskatchewan is to be "within a reasonable driving distance from a provincial or regional park". (See 4(c)).

As far as can be determined, there is no significant history of the administration of joint provincial-municipal regional parks. Discussion of this sort of parks administration must therefore be conducted on a more or less theoretical level. If it can be agreed that one range of parks functions is properly the concern of the municipality exclusively, and another range the concern of the province exclusively, then it becomes possible to discuss whether or not there is an intermediate range of parks needs to be filled, and if so how. What type of parks fall into this category? To what extent should the municipalities share in their establishment, control, maintenance? To what extent should the province share? What aid should the province provide other than financial, if any? A more searching question is raised: Falling as it does in the administrative no-man's-land between municipal and provincial jurisdictions, is the regional park one of a number of functional needs calling for the creation, utilization or strengthening of second-tier municipalities embracing broad trading areas or similarly defined territories?

Both the Saskatchewan and Ontario regional parks statutes place the initiative for establishment of a park on the municipalities. Only time will tell whether the municipalities will accept the responsibility fully enough and soon enough. Meanwhile, the question stands: how much of the initiative for regional parks ought properly to be left with municipalities?

(iv) *Conservation Areas as Regional Parks.*

One answer to the regional park problem, an answer that possesses a built-in economic justification, is provided by recreational use of land in river valley conservation areas. In river valleys, lands in the flood plains are adaptable to very few uses indeed; in other parts of river valleys, the stream banks must be protected against erosion and accordingly there must be restrictions on the uses to which the land is put; in yet other places, reforestation for purposes of water conservation limits land use. It frequently happens that recreational uses can be permitted in such areas without any conflict with conservation objectives.

In Ontario, a Conservation Authority can be set up by the provincial government to supervise the safeguarding of a watershed or a number of adjoining watersheds, on the initiative of some at least of the affected municipalities (the plural is of the essence). Elaborate provisions assure the representation of all participating municipalities in the running of the Authority and the fair apportionment of costs of each project among the municipalities benefiting from it (Conservation Authorities Act, 1946 and amendments). The Province is also permitted representation on an Authority to which a provincial grant is made. *Advisory Boards*, which share in the making of executive

decisions, may be created to assure consideration of all the related aspects of watershed conservation: reforestation, flood and pollution control, land use, recreation and possible educational activities. In these ways, obviously, numerous local citizens become actively involved. The relationship with representative institutions and the electoral process is not always clear.

The Province assists in three principal ways:

(1) it pays 75 per cent of the costs of the preliminary engineering studies required for a conservation scheme;
(2) it pays 50 per cent of the initial capital costs of a scheme;
(3) it may assist with personnel: two technicians of the Ontario Department of Planning and Development are seconded to the Metro Toronto Conservation Authority.

The development of land for parks use can never be more than a by-product of the primary functions of a watershed Conservation Authority, but experience proves that it can be an advanced, valuable by-product and, indeed, that the park developments can be carried much further along than the dictates of conservation demand. The submission to this Conference made by the Metropolitan Toronto and Region Conservation Authority urges the development of the recreation sector in these terms:

> "Lands acquired by Conservation Authorities must, in the first instance, be capable of performing a job relative to conservation: For example, flood plain land, valley slopes, source areas, reforestation land, etc., are suitable. If these lands can, in the second instance, be used for recreation without seriously interfering with their primary task, then they *should* be so used. It is recognized from this basic interpretation of the legislation that not all forms of recreation are possible on conservation lands, and secondly that there is a limit on the number of people which an area of conservation land can support for recreation purposes. While there is little factual information available on this second point, it appears that the number is considerably less than on conventional park land."

The co-ordination of parks development in urban areas with conservation programs need not depend on the initiative of the local municipalities, as it does under the Ontario Conservation Authorities Act. The province may also move into this field. Ontario did so in establishing the Ontario-St. Lawrence Development Commission, Saskatchewan is doing so in its development of the South Saskatchewan River.

One of the most promising facets on the river valley conservation approach to the provision of recreational land is the tendency of population centres to emerge by or near waterways: that is to say, this solution can often be applied where the need is actually or potentially great. Enthusiasm for this attack on the problem of overcoming park land scarcity must not blind us to the fact that it is a left-handed way of promoting recreation. In the nature of things, recreation must remain at best the secondary concern of conservation authorities. It cannot be hoped that this approach will provide basic solutions to any of the major problems in the field of parks and recreation.

(v) *Provincial Parks.*

The administration of provincial parks as such has not the complexity at the base that a Conservation Authority or a jointly sponsored regional park program has. Referring again to Ontario as an example, not necessarily as a model, the Department of Lands and Forests Parks Branch administration is described herewith.

The Department divides the province into seven districts, each of which is organized with much the same range of divisional offices as the Toronto head office. Two of the districts cover the populous southern part of Ontario; the remainder are in the north. An important distinction must be made immediately: Provincial Crown lands are quite plentiful in the north but are extremely scarce in the thickly settled south.

Recommendations for park locations are made to the central office of the Parks Branch by the parks supervisor of each district, with supporting data concerning access, water supply, vegetation, etc. Such a recommendation might, of course, originate with a private person or group. If the central Parks Branch sees merit in the suggestion, it will be circulated among the various branches of the Department – including Fish and Wildlife, Forest Protection, Surveys, Operations, Timber, Research – to see how the recommended site would conform with their programs. If the location is agreeable to all of the departmental branches, the recommendation is forwarded to the Ontario Parks Integration Board. The recommendation will be, basically, a request to reserve a portion of the Crown lands or to acquire a stretch of privately-owned land. Clearly, it is easier and less expensive to reserve Crown land than to buy private land; hence the relative difficulty of obtaining sites in southern Ontario where, of course, the need for parks is greatest.

The Ontario Parks Integration Board, as the name implies, is a provincial agency that endeavors to co-ordinate the efforts of the various public parks authorities active in the province, notably the Department of Lands and Forests, the Conservation Authorities, the Ontario-St. Lawrence Development Commission, and the Niagara Parks Commission. It was established in 1956. The members of the Board are the Provincial Treasurer, the Ministers of Planning and Development and of Lands and Forests, the Chairman of the Niagara Parks Commission (himself at present a Minister) and the Chairman or a Vice-Chairman of the Ontario-St. Lawrence Development Commission. The Board is the final co-ordinating authority for the regional and provincial parks system. Through the presence of the Provincial Treasurer, the parks system, which requires a fairly heavy capital outlay each year, is correlated with the other needs of the province. The Board has itself no staff other than clerical; this, it may be argued, is a point in its favor, for the constituent members have staffs of their own to help them reach their decisions without further referral to the administrative level.

The evolution of the provincial parks administration in British Columbia is interesting, as it reflects the growth in importance of the recreation function of government.

The first B.C. Provincial Park, Strathcona Park on Vancouver Island, was established in 1911. The period of most rapid development came during the depressed 1930's; by 1940 the system included nearly 6.5 million acres. Today, there are 8.5 million acres in 155 different areas in B.C.'s provincial parks.

In 1940, when the system had reached something approaching its present dimensions, administrative responsibility was housed in the Parks Section of the B.C. Forest Service, employing the professional services of two foresters. In 1945, the agency's terms of reference were broadened and its name was changed to *Parks and Recreation Division*, B.C. Forest Service. Then in 1957, the legislature created by statute the Department of Recreation and Conservation. "The result is", reported the new Department in 1957, with a note of pardonable exultation, "that British Columbia can claim the first Provincial Minister of the Crown in Canada of a department organized to blend together the major elements of outdoor recreation." The parks function in particular is handled by the Parks Branch; in 1958-59, the current expenditure of the Provincial Parks Branch was $900,000 out of a total departmental expenditure of $2.3 million.

Ontario provides an example of parks system organized through a branch of a resources department, and British Columbia an example of a department which recognizes recreation as a prime concern. Whether a province will choose to administer recreation through a department or a branch of a department depends on how important, relatively, it considers recreation to be. From the viewpoint of administration, however, the choice can and almost inevitably will make a great deal of difference. A branch, one of many in a department, is unable to take on commitments independently. Dealing with representatives of other levels of government, provincial branch officials are obliged to await confirmation of their proposals from higher up; such confirmation will not normally come until various other branches have been consulted. The complications multiply when the responsibility for the recreation function is dispersed among departments and other Crown agencies.

Furthermore, the province being the *middle level* of government, its administrative machinery is obliged to work together with both municipal and federal governments. The two relationships are obviously quite different, a consideration which does nothing to ease the task of intergovernmental co-ordination.

Finally, the absence of a clear division of responsibilities between federal, provincial and municipal levels of government naturally obstructs co-ordination between them, and would do so even if the administrative machinery were the simplest imaginable.

The last point, here as in every other portion of this paper, rises to the top. What *should* the provinces be called on to do in the recreation field? When that question is answered, the administrative problems will at least be more clearly defined.

(vi) *Private Agencies.*

Private activity in the parks field takes three forms of importance to parks administration:

1) provision of facilities by public-spirited bodies such as service clubs,
2) operation of private parks by commercial entrepreneurs,
3) support of parks programs by private recreation associations.

No one of the three forms of activity is of one kind in all cases. Nothing short of a list would convey the full scope of private initiative. A brief note of certain aspects of each will be more useful than a summary that is bound to be inadequate.

1) Commonly, service clubs are generous with donations of equipment and even of large-scale structures, mostly for local parks but often for outdoor camps,

etc., as well. In Edmonton, the Kinsmen have erected facilities costing a quarter of a million dollars in a park along the Saskatchewan River. Where a reasonably strong park authority exists, charitable efforts of this kind can readily be fitted into a recreation program. Often enough, however, donations fill a virtual vacuum. The problem in such cases is to make sure that the money is well spent, for the sake of both donor and beneficiary. At the same time, the chilly hand of bureaucracy should not be allowed to freeze a generous impulse. A professional recreation director might not have been prepared to say that the town of Rocky Mountain House, Alberta, needed a rodeo ground more than anything else; but if that is what a service club was bent on building for the town – and it was – there may be no justification for interfering. The limiting factor is the commitment for maintenance that can fall on the municipality; if great, the maintenance burden would justify a municipality in declining such an offer.

2) Leaving aside private *rod and gun* or other outdoors type clubs whose members are willing to pay for one degree or another of luxury and/or privacy, and considering only commercial operators of facilities open to the public, it is difficult to see how an outdoor park operator can compete with provincial or regional parks in the facilities they provide. On the other hand, the very nature of the public outdoor park eliminates it as a competitor in several fields of recreation. An official of the Metro Toronto Conservation Authority expressed the rather unexpected view that there were not enough amusement entrepreneurs in the neighborhood of the Metro conservation areas. Plenty of scope exists in such places for privately-operated swimming pools, hotels, golf courses of the conventional and the *par-3* variety, and so on. Naturally, no use of land could be permitted which by proximity would injure the fundamental concept of the public park, but only the pessimist would insist that this condition leaves no room at all for private enterprise.

3) Support of parks programs by organizations made up of interested persons, such as the Dominion-Chartered Parks Association of Greater Toronto, assists parks administrators in a promotional way. It is not easy to determine where assistance to the administrators ends and pressure on politicians begins. Certainly a great deal can be achieved by people who organize on behalf of recreation as a cause.

II. *Parks and Recreation in Relation to Government Organization.*

(i) *Parks and Planning.*

Planning – meaning the work of the professional planner, not *planning* in the general sense of deliberate forethought – is a fairly new governmental instrument. It bears immediate relevance to parks and recreation. Recreation is a land use – in fact, a range of land uses. The planner's craft is to apply precise data to a problem in accordance with principles that have a proven scientific validity. The planner can assist the parks authority, be it municipal, provincial or regional, in every aspect of its program other than day-to-day operation: location, size, nature of service required, auxiliary facilities (e.g., parking), maximum exploitation of access, staging of development, anticipation of usage.

The provinces, generally speaking, exercise supervision over municipal planning. In administering their own functions, do provincial governments themselves make the best use of planning techniques? There is room for doubt. Attention is apparently given to the need to consider projects from many viewpoints – but this is not planning.

It has been noted that the thorniest problems in the parks field lie in the realm of *regional* parks. This is symptomatic of a larger difficulty, the lack of a true regional unit of government, which shows itself equally clearly in the near-total absence of authorities for regional planning.

Planning within municipalities has won very wide acceptance now in Canada. The general rule is that the province allows the municipality to choose whether or not to institute the planning process; but once the choice to do so is made, the municipality is subject to quite close regulation in the planning it does.

Another characteristic of local planning in Canada is the separation of the planning function from the direct authority of the Council. In Ontario, for instance, planning in a municipality is the responsibility of an appointed *planning board* on which by statute elected representatives cannot be more than a minority. The *independence* so bestowed on the planning board has in practice a double effect: it becomes easier for planners to draft their plans, but more difficult for the plans to gain Council approval.

The wise use of land for recreation is an important objective of planning. This might be put even more strongly: it is entirely likely that parks and recreation will be one of the first governmental functions to suffer from the absence of effective municipal planning.

An essential precondition, then, of the best possible use of local land resources for parks use is the installation of workable planning procedures in municipal governments. If planning is not being done, it should be; if it is being carried out under conditions that pre-

vent its effectiveness, the conditions should be changed.

(ii) *Theories of Organization of Government.*
A marked feature of twentieth century government, no less in Canada than elsewhere, has been the rise in importance of separated boards or commissions, appointed bodies carrying out functions of government while being more or less independent of the elected representatives. Examples in the parks field in Ontario at the provincial level are the aforementioned Niagara Parks Commission and the Ontario-St. Lawrence Development Commission; at the local level, there is the *Board of Parks Management*, and, as we have seen, there is a direct relationship between the parks function and the planning board.

There has been voluminous discussion of the merits and demerits of such separated bodies. A recent example is the report of the Gordon Commission on the Organization of Government in Ontario, 1959.

Such bodies have one great merit: they do achieve results relatively quickly. It would appear that the independent commission is a good device with which to overcome initial inertia. Where public support of the policy concerned is strong and clear, such dynamism is praiseworthy; but the student of government who approaches the matter with leanings in favor of representative institutions must adopt a skeptical attitude toward the continued existence of each individual separated body performing a governmental function.

(iii) *A Point of View.*
To focus further discussion it may help if the writers state their point of view on this subject. Moreover, this point of view naturally underlies any judgments expressed in this paper, and in fairness it ought to be made explicit.

1) We believe that at all levels parks and recreation ought to be administered by regular departments of government responsible in the normal way to the elected representatives of the people. We believe this both out of loyalty to the ideals of representative government and – this we underline – out of concern for efficient management. At the local level in particular, the fragmentation of government responsibility among boards and commissions robs elective office of its challenge to superior talent, impedes co-ordination of effort, and also deprives the fragmented functions of the services of the most outstanding public leaders. We see this problem as a vicious circle: amputate from the elected Council many of its responsibilities and powers, and you make elective office the price of smaller men; fill your Councils with smaller men, and it becomes necessary to reduce further their responsibilities and powers. We would declare that both to assure public control of a public issue, and to assure continuous top-quality administration in the long run, parks and recreation policies should be placed firmly in the hands of the people's elected representatives.

2) Again referring to the local field, parks and recreation is only one public function whose character has altered with the passage of time. Generally speaking, the city and town have changed so much in the last five decades or so that all local government functions have changed too. We must not shirk the question of whether municipal institutions have changed in keeping with the changes in the jobs they must do. For instance, in objection to our last point, it might be argued that a councillor cannot possibly learn enough in a one or two-year term to shape recreation policy. If this be true, which of two things ought we to do? Should we take parks and recreation out of the hands of councils and put them into the hands of persons, even devoted persons, who need never justify themselves to the voters? Or should we lengthen the councillor's term of office? Frankly, we prefer the latter. But the point is that the administration of parks and recreation, to be understood, must be seen in its context as but one problem in the organization of government.

3) Similar considerations apply to the question of regional parks. We have suggested that regional parks pose the most difficult administrative problem in the recreation field. But once again, the parks function is far from the only regional requirement that has proven to be an administrative stumbling-block. The basic fact is that concentration of population, facility of movement, and increase in leisure time, among other irreversible modern phenomena, have given a new economic and social reality to regions embracing areas far larger than our cities and towns, generating special problems that cry out for solution on a regional basis. The only answer is the establishment of regional institutions – not regional single-purpose bodies (e.g., for water supply or sewage disposal) but regional institutions with comprehensive responsibility for dealing with regional problems. What is needed, in short, is a second-tier municipality that places policy responsibility for regional functions in the hands of elected persons. The metropolitan areas of Toronto and Winnipeg have responded to the challenge in their own ways. No doubt other regions will seek different answers. Our basic point is that the most fruitful long-term approach to regional parks administration is the development of new regional government institutions.

Bibliography

Algonquin Provincial Park. Ontario Department of Lands and Forests. 1958.

Canada Year Book, Dominion Bureau of Statistics, Ottawa, (Annual): N.B. 1954. pp. 21-32.

Citizens Research Institute of Canada, *Submission to the Committee on the Organization of Government in Ontario*, Toronto. 1959.

Civic Affairs, Bureau of Municipal Research, Toronto, January 1960. "Terms of Reference for Appointed Members of Local Boards and Commissions."

Conservation in the Metropolitan Toronto Region, A Submission to the "Resources for Tomorrow" Conference. Metropolitan Toronto and Region Conservation Authority. 1960 (unpublished).

First Biennial Report. Metropolitan Toronto and Region Conservation Authority, Toronto. 1959.

Municipal Year Book. The International City Managers' Association, Chicago, (annual)

Now or Never: A Bold New Program for Outdoor Recreation. State of New York Conservation Department, Albany. 1959.

Oakes, Sir Cecil and Dacey, W.L., *An Outline of Local Government and Local Finance in England and Wales:* Sweet and Maxwell, London. 1950.

Our Valley. Ontario Department of Planning and Development, Toronto, Vol. 6 No. 2 (Summer 1960).

Outdoor Recreation Survey. A report of the State of New York Conservation Department, Albany. 1960.

The Provincial Parks of Ontario. Ontario Department of Lands and Forests, Toronto. 1959 (and *Supplement*, 1960)

Report of the Committee on the Organization of Government in Ontario, Queen's Printer, Toronto. 1959, N.B. pp. 48-57.

Report, Royal Commission on Forest Reservation and National Parks (Ontario). Alexander Kirkwood, Chairman, Queen's Printer, Toronto. 1893.

Rowat, Donald C., *The Reorganization of Provincial-Municipal Relations in Nova Scotia;* Institute of Public Affairs, Dalhousie University, Halifax. 1949.

Schulz, Ernst B., *American City Government: Its Machinery and Processes:* Stackpole and Heck, New York, 1949.

Toren, Eleanor R., *Metropolitan Parks, A Report to the Metropolitan Joint Committee*, Vancouver, 1959.

Wisdom's Heritage — the National Parks of Canada, Queen's Printer, Ottawa, 1957, (extract from Annual Report, 1956-7, Department of Northern Affairs and National Resources).

Provincial Statutes, notably Ontario Parks Assistance Act (1960) and Regulations, Saskatchewan Regional Parks Act (1960) and Regulations.

Annual Reports of various provincial Departments of Resources, Recreation, Conservation, etc.

Section Nine: General

Renewable Resources Information and Education in Canada

D.F. Symington,
Research Associate,
Resources for Tomorrow
Conference

The place and function of the resources information agency in provincial resources administrations has not been fully defined. Agencies have not developed according to a pattern. Few facilities exist for formal training of resources information personnel. Criteria are lacking for measuring the professional competence of personnel and the degree to which programs meet administrative and other requirements.

Notwithstanding, much worthwhile work is being done in most provinces. The work generally consists of routine administration such as correspondence, reports and synopses of regulations, or operational activity such as forest fire control. Some other work relates to ecology, land use, descriptions of flora and fauna other fundamental information.

The problems faced by information and education agencies vary among the provincial governments. Problems common to many are as follows: lack of definition of function and of status within the departmental hierarchy; lack of means of measuring the effect of public information programs; failure of administrations to precede resource management programs with suitable programs of public information—thus creating crisis situations; lack of liaison with educational institutions; obscure definitions of jurisdictional responsibilities among the various types of government information agencies. Less than one per cent of resource department budgets is allocated to public information and education. Skilled, experienced information and education personnel in all Canadian governments do not number more than a dozen people.

The objectives of a practical information and education program include development in the public of a critical awareness of the factors of resource management that impinge on the welfare of the community, the nation and the resources themselves. Community leaders especially should be aware of the criteria on which to base wise decisions on resource use. Understanding of the recreational and esthetic values of resources is of paramount importance.

Many administrators recognize that information programs are an essential component of resources management in a democracy. However, there is a wide disparity between the level of recognition of the need and the level of practical attempts to meet the need.

The role of the field man in public information on resources is thought to be of paramount importance. However, the field man requires support in the form of lucid policy statements and carefully cultivated public interest and sympathy. In-service information and training programs are essential.

The quality of writing produced by an information agency is, in the final analysis, the measure of its effectiveness in helping to meet problems of resource management. Personnel trained in the art of communication and familiar with the disciplines of resource use are essential. They must contribute to the evolution of resources information and education into a recognized discipline, with criteria and professional standards conducive to a high standard of integrity and craftsmanship.

A localized approach to information dissemination is essential, inasmuch as social attitudes vary greatly between localities. Regional information-education officers, and carefully selected, well-trained Conservation Officers are necessary to achieve this.

The techniques and methods normally associated with public relations work are a valuable component of resources information programs. However, there is some danger of mis-use of highly developed public relations techniques. Protection against mis-use lies in the development of professional criteria to govern the activities of information agencies, and in the development of an informed and critical attitude by public media writers and editors.

In the absence of means of evaluating resources information programs, there is no concrete evidence that money is being spent to productive ends. Techniques exist which may be used to assess public reaction to information programs. Expert personnel are required to

93452—69

apply these techniques. The result would be a guide for and justification of programs, and more sensitive interaction between government and the public.

Liaison among public information agencies of a government is essential. Lacking adequate liaison and definition of objectives, mutually beneficial interaction among such agencies is impeded. Development of enough professional resources information personnel is probably contingent on general recognition that the resources information function is separate and distinct from the functions of other government information agencies.

Notwithstanding the social usefulness of good government-sponsored resources information material, there should be countervailing power *in the form of independent agencies devoted to reporting in depth on resource use situations.*

A further subject, suitable for discussion at the Conference, is the possible desirability of establishing regional or national information agencies. Such agencies might carry out functions that are of a national character, or which might be inefficient or financially unfeasible if carried out individually by provinces or localized non-government agencies.

The individual seldom has a direct and personal economic relationship with renewable resources other than agricultural land. Even though a co-owner of national wealth he is unlikely to be deeply concerned with its management unless he has a clear understanding of the factors of resource use that will indirectly affect his well-being. The general public, if not deeply aware of the place of humans and other species in the biological community and if not cognizant of the social and economic values of renewable resources, will be largely without intellectual means of judging management practices and over-all resource development policies.

A practical indication of the level of public concern with private (as opposed to public) resources is seen in the quality of information and education facilities acceptable for agriculture, on the one hand, and all other renewable resources, on the other. Agricultural extension services have become a generally accepted responsibility of governments, universities and public schools, with trained professional teachers, extension workers and information writers. Conversely, the non-agricultural renewable resources information and education services of Canadian governments are usually maintained austerely by administrations that recognize a use and potential but have not yet defined function and status. There are no formal means of developing professional staff; no specific facilities are provided to train resources information and education personnel in universities; few general courses in universities aim at developing an understanding of resource management; almost no university extension work is done in this field; almost no specific attention is paid to resource management and ecological principles in normal schools and teachers colleges.

The desirable place and role of resources information and education agencies cannot be deduced from existing practice. For a clear and objective view of information and education programs, in relation to resource management, we must find answers to two fundamental questions. First, is an information and education program an integral part of resource management programs, with recognizable and definable functions? Second, is the information and education function of management being developed into a recognized discipline?

These two questions may lead to quite a flow of subsidiary questions. For example: What are the criteria for judging the professional capability of staff? Where does an information and education agency belong in an administrative structure? What status should it have as compared with other divisions with more specific management responsibilities? What part should it play in policy formulation? What are its proper rights and prerogatives (and limits and standards) of a professional nature? What kind and size of staff should it have? What level of budget? What kind of working relationship with other government agencies that are directly or indirectly concerned with resource use? What is the function of an information and education agency as regards informing (or influencing) other departments? What is the part of non-government agencies in public information and education? Is measurement of public reaction to information and education programs feasible? Is it essential?

Part I of this paper will examine information and education programs in Canada, outlining problems that exist and, where possible, examining some of the above questions as they relate to current practice.

Part II will present a conception of a practical information and education agency which gives due consideration to the above questions.

Part I

The Setting–Agencies

Five major categories of agencies originate and disseminate information on renewable resources:

(1) The federal government,
(2) Provincial governments,
(3) Special interest groups such as the forestry associations, fish and game leagues and various private industrial and commercial concerns,
(4) More or less independent public service and study organizations such as the natural history societies, Women's Institutes, Boy Scouts, etc.
(5) Public media such as newspapers, magazines and radio and TV stations.

Because of the nature and scope of the provincial governments' responsibilities for management of renewable resources, it is taken as axiomatic that the primary responsibility for collection and dissemination of information rests with agencies of these governments. Each of the other categories has a distinct and highly significant place in a national approach to resources information and education, and each contributes significantly at the present time. Such agencies appear to require fuller definitions of purpose and function, and enhanced means of achieving these purposes. This, however, is beyond the scope of this paper, and will be discussed mainly in relation to the functions of provincial governments.

Jurisdictional considerations are pertinent to the operation of any administrative agency, and especially so for an agency with ill-defined functions such as resources information and education services. Analysis of jurisdictional considerations among various governmental renewable resources agencies is the subject of several Conference papers, but it may be worthwhile here to mention one simple indication of the complexity of the jurisdictional pattern–the naming of the departments concerned.

Seven of the ten provinces have agriculture departments. Four have lands and forest departments. Two have industrial development departments. In the nineteen remaining departments directly associated with natural resource use there is no duplication of names. Obviously, administrative responsibilities and jurisdictions do not conform to a pattern, even among provinces with similar geographic and economic characteristics.

One may presume that this diverse pattern of jurisdictions serves the immediate purposes of the professional management and administrative personnel who function within them, but, given this lack of systematization of administrative jurisdictions it is understandable that resources information agencies should not have developed according to any clearly defined set of principles or even of working methods.

In Saskatchewan, Manitoba, Alberta and Ontario, for example, tourist publicity and promotion agencies are completely outside resources departments. In British Columbia tourism is within a resources department–which in turn is separate from the administration of public lands and forests. In Manitoba one resources department whose broad purpose is development and industrial promotion contains the information agency whose general terms of reference include public information on renewable resources. There are many other and similar examples.

Notwithstanding, many concepts of resources education, both in-service and public, are finding expression in the activities of most administrations, and there are many examples of concrete achievement–examples which may serve to point up possibilities.

Public Information and Education Activity

All provincial resources departments agree that resources education in the schools is a prime requirement. Most directors of curricula agree that resources information should be included in such subjects as social studies, history, geography and the sciences, and many courses do give some attention to resources. In one province–Saskatchewan–there is a continuing committee functioning for the purpose of providing the Director of Curricula with information and guidance in incorporating modern concepts of integrated resource use into various subjects. Saskatchewan has developed an elementary school curriculum guide for science which includes detailed treatment of resources, and a teacher's manual which elaborates on aspects of resource use and methods of instruction. Alberta has established a somewhat less detailed course of study of similar content. British Columbia has a well-developed program of formal lecturing to school pupils by specialists in renewable resources. These specialists are supplied by the Department of Lands and Forests.

Resources atlases are published by British Columbia, Manitoba and Ontario. The British Columbia atlas is very elaborate and comprehensive.

In British Columbia, credit courses related to conservation have been established at the University, one academic and the other based chiefly on the use of field studies.

Nature trails have been established in B.C. where 30,000 individuals are given instruction on the outdoors each year.

Some attention is given in all provinces to instruction of youth groups, such as Scouts, Guides and 4-H Clubs. Ontario has published excellent scout manuals that supply a detailed description and discussion of integrated resource use.

Some films are produced on resource subjects, notably in British Columbia where several films devoted

to resource management have been produced specifically for audiences in that province. Extensive film libraries exist, containing outstanding conservation films, some of which are of Canadian origin. Slides are also used extensively as aids to lecturing. Film distribution appears generally well-systematized. Saskatchewan, for example, maintains 250 films *in circuit*, largely for the use of Conservation officers, and provides them with about 100 slide projectors and slide sets depicting various resource use themes.

British Columbia and Alberta produce outdoor magazines, mainly for free public distribution, with a circulation list of about 30,000 and 7,000 respectively.

All provinces conduct general courses for field staff, which usually include a limited amount of instruction in public information and education techniques. Aids to lecturing, exhibits, pamphlets, films, etc., are supplied to field officers, although no provincial department has developed a field officer's handbook on public education or systematized the provision and circulation of aids. In Saskatchewan and Ontario field officers are provided with newspaper *column* material called *Conservation Corners*, which may be modified by the officer to suit local conditions before being placed with the local weekly newspaper editor.

Some attention is given to forestry extension work – mainly relative to harvesting techniques and woodlot management.

News releases are used by all resource departments as vehicles for dissemination of information. However, one desirable feature for effective use of news releases is as yet not very fully developed. This is the use of news releases as series, each release elaborating some aspect of a resource management program.

Forest fire prevention campaigns and similar aids to specific administrative programs have been diligently carried out in most provinces.

Departmental officials and field staff give some public lectures; radio and television are employed to varying degrees; posters are used for a variety of purposes; events such as forest conservation weeks, gun safety week, etc. are designed to focus public attention on a problem; writers are catered to, and occasional elaborate writer tours are sponsored; members of scientific and administrative staffs contribute to professional journals; a certain amount of paid advertising is done; many nature exhibits are used as well as a variety of other small but significant accomplishments in the interests of informing the public.

An Exercise in Assessment of Current Information and Education Publications

Is the volume of material produced by a resources information agency a very useful measure of its contribution to basic objectives of information and education programs? Most agencies prepare annual reports, write news releases that are not part of a defined public information program, write speeches for various officials, answer correspondence, and so on. Although these may be useful functions from the standpoint of the administration, they contribute little to public understanding of resource management and other valid program objectives.

A second category of activity concerns public information programs intended as aids to achieving specific resource management goals, such as fire prevention and improved hunter-farmer relationships. Intensive information and education campaigns have evidently proven of value in achieving such direct goals, and are widely employed. In the main, the part of the public in such programs is passive, involving abstinence or acceptance.

Optimum management of resources is, however, not often simple and direct. Many complex programs, to be successful, require positive and dynamic public participation and support. Are current programs oriented to this particular need–to develop public understanding of the various species and their interrelationships, and various management alternatives and their probable consequences?

On the assumption that the number and kind of publications available for public distribution would indicate fairly accurately the orientation of programs, the writer canvassed the resource agencies of all provinces for such material. A total of 361 publications were received. Of these, the writer judged 298 to be either administrative, (annual reports, technical reports, synopses of regulations) or operational, (tourist promotion, gun safety, woodlot management, forest fire control, hunter-farmer relations, etc.). The remaining 63 publications had, as their basic theme, information on wildlife and plant species, resource management, resource harvesting technology, ecology, research or broad descriptions of resources within a given area. Ten of these publications were periodicals.

If the above figures can be taken as approximately representing the orientation of programs generally, it is apparent that basic education on resources and resource management comprises about one-sixth of such programs. Some of the factors contributing to this orientation are implicit in the problems faced by information and education personnel in the normal course of their work.

Current Problems Relating to Resources Information and Education Programs

Personnel responsible for public information on resources view the lack of funds and trained writers as a major problem.

When considering the availability of trained personnel, it is necessary to define the term. For the purposes of part I of this paper, a trained resources information and education man is defined arbitrarily as one who has had five years' experience during which his major responsibility was to prepare written material on renewable resources for dissemination to the public. A college degree in arts, journalism, or biological science (or related subject) may count for three years' experience. Three years or more of field work in a resources department, or as a news reporter, may count for one year.

By this definition, trained resources information and education personnel in all Canadian governments number about twelve, (exclusive of the scattering of professional foresters engaged in specialized extension work).

Of all the money spent on administration of renewable resources among Canadian governments in 1959, less than one per cent was spent on public information on renewable resources (exclusive of tourist and industrial promotion).

Viewed in the light of these figures, should lack of funds and trained staff be considered as a problem in itself or as the symptom of a number of problems?

Lack of Definition of Status and Function of Information and Education Agencies

With two partial exceptions, resources departments have not formally defined their resources information policy with regard to (1) its place in the administrative hierarchy of the department, (2) its relationship to the total information and education effort of the government, (3) the management of resources.

The value of the material they produce may be assessed mainly in terms of satisfying immediate administrative requirements rather than of meeting specific goals in public information and education.

Without functional definitions, most, if not all, information and education agencies function as service agencies in relation to any writing or publicity that seems to be required by other agencies of the department. Lacking means of evaluating the results of their efforts, they are generally unable to compete on equal terms for status and support with central planning and line organizations which have direct administrative responsibilities for resource management. They operate without any regional staff whatsoever. They apply the lore of their special field of knowledge in an informal advisory capacity, seldom participating in policy formulation to the degree commensurate with the potential inherent in their position as assessors and modifiers of public opinion.

Most administrators recognize that information and education work may contribute to operational effectiveness, and employ information and education agencies extensively for such work. While agreeing that this may be an essential function, professional information and education personnel conceive it as an extremely limited one. They feel that however useful a handmaiden task in operational situations may be, this type of function should not dominate information and education activity.

Lack of Means of Evaluating Resources Information Programs

Techniques have been developed to measure the effect of advertising, public relations, and public information programs in general; yet there is no instance in Canada of specific application of these techniques to renewable resources information and education programs. Crude assessments have been made by computing the amount and apparent value of newspaper and magazine space resulting from programs, or by analysis of favorable and unfavorable comments by editorial writers and letter writers, or by rule-of-thumb assessments of public reaction to administrative programs which were accompanied, or were not accompanied, by public information programs. But with an almost complete lack of survey facilities, and in view of the many variables involved in an assessment of public reaction, it is impossible to offer a valid assessment of any resources information work so far carried out in Canada.

"Crisis" Public Relations Work

Many resources information and education specialists believe that resources administrators and the government executive tend to *spring* resource management programs on the public without preceding them with a long-term, planned program of information, and, if public reaction proves adverse, to give the task of righting the matter to the information and education agency. Information and education personnel believe that a well-planned series of public information programs, drawn up with reference to the department's long-term plans of research and management, would do much to avert such crises. To be effective, information and education practice should be directed towards creating a climate for positive reaction, rather than counteracting a negative reaction.

Lack of Liaison with Formal Educational Institutions

Resources education in the schools is, except for four important programs, largely neglected. Most education departments agree that education must aim at developing understanding of the environment, and that renewable resources comprise a tremendously important segment of the environment. Most teachers can point to often-detailed discussion of renewable resources in various subjects.

There are neglected areas, however, especially in the development of a conception of the interrelationships among living things. Many fallacies and outright inaccuracies and mistakes occur in material used in schools. The level of resources education in a given school is largely the product of the personal interest of the teacher in the outdoors and resources generally. Few classes in colleges or normal schools prepare teachers to satisfy the natural curiosity of pupils, let alone develop understanding of ecology and resource management.

Conflict of Jurisdictions

Information and education agencies function in governments which also include tourist promotion agencies, industrial promotion agencies, one or more general news and information agencies, public relations men, agricultural extension workers, curricula directorates, etc. In several provinces problems of some importance have resulted from the fact that the distinction between work of such agencies and work and resources information and education agencies is not always clear. For example, the resources information and education agency has distinct responsibilities for public information in relation to fish, game and other wildlife, water, forests, hunter-farmer relations and other recreational uses of renewable resources. The tourist promotion agency seeks to increase the use of these resources by advertising and other devices. The information and education agency must describe objectively whereas the tourist agency, involved in a highly competitive industry, cannot be fully objective.

Clearly understood departmental and interdepartmental policies on public information and education, close lower-level liaison, and meticulous respect for the professional standards of each party are essential. In their absence, difficulties occur which may result in highly emotional reactions that are extremely detrimental to all resources information programs and indeed to all governmental public information programs.

Part II

Functions and Objectives of an Information and Education Agency, and Considerations Governing These Objectives.

Preamble

Part I of this paper indicates that the administrative framework within which information and education agencies operate is not consistent among the various governments; that clear definitions of the function and status of the agencies have not been made; that funds and skilled staff are extremely limited; that relationships with other governmental agencies are often indefinite.

Resources information and education is a relatively new field of activity for most Canadian governments. No body of literature is available to provide a conceptual background against which to measure existing facilities and programs. Because of this, the writer has felt it essential to present a concept of the role and possible problems of a practical program. Such a concept might be examined to establish to what degree it is suited to any given combination of resources, people, geography and economics. And it might serve as a useful criterion in establishing the degree to which governmental and other agencies are achieving programs adequate to the need.

General Objectives of Resources Information and Education Programs

The general objectives of an information and education program may be presented in point form as follows. Several of the objectives as stated overlap, but each represents a particular and important theme which must be treated in any comprehensive program.

1) To enlarge understanding, especially on the part of group, community and government leaders, of the broad trends in national development — economic, social and demographic — and the ways in which resources may be used to enhance desirable trends.
2) To develop public awareness of the economic, social and political factors that tend to inhibit optimum use of resources, and to develop public demand and support for valid administrative programs.
3) To provide the public with criteria on which to base wise decisions on resource use.
4) To create an interest in resource use in the minds of citizens, and to inform them on the significance of natural interrelationships and the means of avoiding disruption of these interrelationships when resources are used.
5) To enhance understanding of the esthetic values of natural resources.
6) To interpret the research requirements of a department for long-term resource development, and to describe research projects and their results in layman's language.
7) To provide information on technology relative to the harvesting and processing of resources.
8) To provide guidance on use of natural resources for recreation.

The Role of Information and Education Programs in Management Programs

Public information programs are widely employed as aids to achieving specific resource management goals, such as forest fire prevention, improved hunter-farmer relations, etc. Intensive campaigns have evidently proven of value in achieving such simple and direct administrative goals, which in the main entail passive

abstinence or acceptance on the part of the public. However, optimum management of resources may involve complex, long-term programs requiring positive and dynamic public participation. It is important to consider whether information and education programs may contribute equally well to these.

The writer knows of numerous examples which indicate that public information and education programs are essential to the achievement of a variety of administrative goals. The recreation sector provides a number of instances. Such a basic matter as creating public understanding of the recreation needs of a city-centered region is considered essential. Stimulation of interest in specific recreational activities is necessary to achieve the orientation of the public to use certain facilities and thus relieve pressures on other facilities.

In wildlife management, a major problem of the future is preservation and manipulation of habitat. Without wide public knowledge of resources interrelationships, the required research and its practical application are unlikely to have public support.

In water conservation and pollution control, popular definitions of the problems, both physical and administrative, are probably the prime requirement. If the importance of jurisdictional considerations is not understood, practical solutions may not be acceptable to the public and their representatives.

The problems of fisheries management, harvesting and marketing are complex and diverse and intimately related to the attitudes of commercial and sport fisherman. There are many instances where rational programs have been perverted by pressures from inadequately informed user groups.

The administration of forests has become an increasingly complex and public matter, in an era of increasing recreational demand, demand for multiple use and demand for the products of the forest industries.

In agriculture, extension work devoted primarily to farming techniques is no longer enough. With the advent of chemical insect and weed poisons, knowledge of ecology is vital to the health of the environment. With a technological revolution well advanced and consequent social change sweeping agricultural commities, increased knowledge of social organization, economics and environmental improvement is required.

In brief: most responsible administrators recognize that almost no resource use situation can be divorced from public reaction; that this may be taken as a first principle in any discussion of resources management in a democracy. However, there is a wide disparity between the level of recognition of the need and the level of the practical attempts to meet the need. The remainder of this paper will be devoted to a discussion of some of the practical considerations that must be faced if information and education programs are to develop as integral components of resource management programs.

The Role of the Field Man

The centrally located, properly organized information and education organization has important functions. In the final analysis, however, the field man – conservation officer, agricultural representative, forester – is the essential link in effective interpretation to the public. This thesis is supported by a survey carried out by the American Association for Conservation Information: the experience of agricultural extension agencies and River Valley Conservation Authorities provides further evidence; various game, forest and fisheries administrators support this thesis. However, field men need direct support in the form of lucid, well-illustrated policy concepts and aids to local information dissemination. They require careful selection and training in information and education work. And they must have indirect support in the form of public interest and sympathy, which may result from the work of a centrally located information and education agency. This requirement – support for field men – implies the corrollary requirement that all departmental employees be information oriented. In brief, a comprehensive program of in-service information is required.

Objectives of In-Service Information Programs

1) To ensure that all officers of the department have a thorough understanding of the various aspects of resources management, and that a sense of shared responsibility for implementation of desirable management policies is inculcated in all members of the departmental staff,

2) To provide library facilities containing both popular and technical material, including audio-visual aids, and to ensure continuous circulation of material pertinent to the scientific, administrative and public information function and to ensure that a useful flow of material is maintained among various agencies, governments and countries.

3) To provide facilities to field men in the form of written informational material, exhibits, photographic material, and concise, simple statements of departmental policy.

4) To give field men some training and experience in the use of such materials

5) To interpret technical and scientific material, presenting it in a form comprehensible and interesting to the layman, with special consideration for the informational needs of senior officials, both administrative and political, of all departments.

Writing as a Prime Function of an Information and Education Agency

The written word might be called the prime mover of information and education programs, because little is said via any medium, whether a formal or informal talk, radio or TV program, or motion picture, that was not originally derived from published material in some form or other. It is therefore worthwhile to consider some of the factors that go into the type of writing that can meet the requirements of a program.

Words are necessary tools of a society seeking understanding, but they are not exact tools. They may enlighten, or they may delude. Well-handled, they compound with the human intellect and emotions to recreate the gamut of human experience. The use of words can be a highly disciplined art, and people will be moved by such art—even moved to attempt to comprehend logic. This point is of such basic and critical importance to any evolution toward well-developed information and education programs that it may be useful to re-inforce it by reference to the opinions held by widely recognized authorities.

On this matter Socrates said "...intelligent writing... is graven on the soul of him who has learned and can defend itself, and knows when to speak and when to be silent". To produce such work, a man must know "the truth of the several particulars of which he is writing... and be able to define them as they are, and having defined them again to divide them until they can no longer be divided, and until in a like manner he is able to discern the nature of the soul and discover the different modes of discourse which are adapted to different natures, and to arrange and dispose them in such a way that the simple form of speech may be addressed to the simpler nature, and the complex and composite to the complex nature."

It is the opinion of Dr. Vannevar Bush that, "The integrater and interpretor of science...can in these days often serve his fellows far more than the individual who merely adds one morsel to the accumulated factual knowledge".

Mr. Gavin Henderson, Secretary of the Conservation Council of Ontario, has stated in a letter to the Conference Secretariat, – "In my opinion the most formidable conservation problem with which we are faced at the present time is how to overcome the lag in the application of the vast amount of knowledge we already have. To a large extent this problem exists because governments dare not commit themselves to bold, forward-looking policies which the public is not ready to accept. The result of this is a continuing round of piecemeal or makeshift policies to deal with problems only after they become critical. The waste of such a process is appalling."

A further comment on information presentation is provided by Mr. Sandham Graves, formerly Editor in Chief of the Victoria Colonist, (personal interview): "Government information agencies pour out hundreds of thousands of words. There is a constant flow of material over an editor's desk. Much of it is unusable. The bulk of the material is unusable by reason of verbiage and lack of context; it moves nothing, it is so colorless".

Professionalism in Presentation of Resources Information

The above propositions provide a context for consideration of the qualifications of personnel required to achieve adequate programs.

Although resource use involves nearly every discipline practised in a modern society, resources information and education is only emerging as a discipline, with criteria and principles as yet incompletely defined. The methods and techniques employed in dissemination of information are much the same as those used by public relations men in industry. The motives, objectives and subject matter are of larger scope, however, and much more complex, inasmuch as questions other than economic questions are involved. The pressures derived from political and administrative considerations are also more formidable than those with which industrial public relations men are usually faced. To meet the needs and cope with the pressures, resources information and education must develop as a discipline analogous to that of social studies (as distinct from social sciences). And it must become quite distinct from all other trades and professions concerned with dissemination of information – as agricultural extension is distinct from these.

A professional approach to resources information and education cannot be achieved quickly, because of the extreme paucity of individuals qualified to implement it. Such a development would involve the cumulative efforts, over a number of years, of a cadre of personnel with qualifications as high, and standards as rigorous, as apply to a formal discipline.

The Qualifications of Professional Information and Education Personnel

Two major categories of professional information and education personnel are required for effective, integrated programs: those who are primarily writers and those who are primarily teachers. Both must have in common a number of qualifications in addition to those normal for such professions. They must have become familiar with the complexities of resources management by university training and association with resources management personnel. They must be capable of participating in policy formulation in their departments insofar as public reaction may be a factor in the implementation of a given policy. They must be capable of resisting the inevitable pressures tending

to undermine objectivity in the presentation of facts. They must be capable of defining concepts of public information programs suited to their particular milieux and the needs of the nation as a whole.

The writer category requires, in addition, full comprehension of the needs and limitations of the public media – newspapers, magazines, radio, TV, etc. – not academically but by virtue of working experience with such media.

Presentation of material to students, whether directly or via textbooks and other written material, is governed by a special discipline. Full integration of natural resources material with subjects currently being taught – social studies, geography, the sciences, etc. – is essential. An adequate system of teacher training in the field of renewable resources is no less essential. Both are probably contingent on the development of the information and education personnel who are capable of fulfilling the requirements of the teaching discipline and who are deeply familiar with resource use.

A third category essential to an information and education program is the scientist competent to measure public reaction to information programs. This, however, is a science distinct from information promulgation, and specialists in this field would not normally be within an information and education organization.

The services of visual aids experts, librarians, statistical analysts and recreation specialists might, depending on individual circumstances, be obtainable within or outside the information and education organization.

A major practical obstacle to the development of skilled personnel for information and education work is the fact that private industry is currently willing to offer public relations personnel of comparable education, training and personal ability salaries of $10,000 to $12,000 a year. Governments are unlikely to find individuals so dedicated to resources conservation as to be willing to undergo extensive training, formal and otherwise, with the objective of entering a field where wages are significantly lower than those obtained in industry, and where employment opportunities are limited.

An Information and Education Approach Tailored to the Local Situation

The economic circumstances within which a social group exists, and the ethnic backgrounds that predominate within a given locality, condition the attitude toward resource management. Social attitudes change as the economics vary and the ethnic and cultural factors change in importance. Groups, not too well lettered, and subsisting more or less precariously on submarginal lands, will have a quite different set of values concerning resources than a sophisticated group in a prosperous farming, ranching or urban area. A speech by a naturalist to the former group might attract few people, whereas a simple motion picture might pack the house. The converse would probably be the case in the more prosperous and sophisticated area. Since the ultimate value of information and education work depends solely on public response the importance of suiting the fare to the audience cannot be easily overestimated. The corollary of this proposition is that regional information and education officers are essential to a well-developed program, so the individual may come to know the tastes and intellectual capacity of the groups he is responsible for informing. Conservation officers and other field staff might play a key role in this if selected and trained with this purpose in mind.

The "Public Relations" Approach in Information and Education Work

The techniques and methods normally associated with public relations work are a valuable and inevitable component of the skills of the resources information and education person. Ideally, public relations entails a frank and objective presentation of facts. The actual practice varies, depending on individuals and circumstances somewhere between the ideal and deliberately misleading propaganda.

At its best, a leaven of the public relations approach may be beneficial. Used improperly or intemperately, skilled public relations work may enhance the situation of a given agency, possibly to the detriment of equally worthy agencies. In the United States it is common for civil servants to make their case publicly and employ pressure-group tactics to the advantage of their particular *empire* or objectives. In Canada this is less likely to happen, although it is possible for improperly stimulated pressure groups to subvert the principle of Cabinet solidarity to some degree. Or a skilled public relations man or publicist may create the illusion of knowledge and action behind the glib phrase; a newspaper screen around impoverished policy.

A very worthwhile guarantee against misuse of the power of the published word through public relations efforts of an information and education agency is to ensure that personnel are responsible individuals. They would be conversant with resources use. They would be capable as a group of developing professional criteria and ethics which would govern the *modus operandi* of specialists in their field.

Such a professional, objective approach on the part of government resources information men has an essential corollary; a critical assessment by public media editors of their own responsibilities regarding resources management information. Their responsibility would not be to condone what appears to be morally ri-

ght, but to find out what is being done, and report it or comment on it editorially.

Evaluation of Public Reaction to Information and Education Programs

Many responsible administrators and virtually all information and education personnel in Canada feel that failure to develop and apply systematic evaluation techniques represents one of the major deficiencies in the present approach to public information and education.

Lacking adequate scientific evidence of the effect of information and education programs, the resources administrator has little assurance that the money alloted is being correctly apportioned. Indeed, he may have little or no concrete evidence to support a contention that any portion of the funds is being spent usefully. Provision of concrete evidence in Cabinet, for consideration of the budget, is quite important.

Techniques to measure the effect of public information programs are known, and have been used effectively elsewhere. However, they have not been used intensively in relation to natural resources. But, in the hands of evaluation experts, these techniques can be successfully applied to the problems facing resources administrators. Development of such measurement techniques must proceed concurrently with development of improved facilities for information dissemination, both as a guide and justification for such programs.

Need for Liaison Among All Government Information and Education Agencies

The level of resources education in public schools varies, probably according to the level of understanding of those responsible for curriculum development. Few teachers are familiar with ecology and resource management and their significance to the welfare of people. Continuous and intensive liaison between education departments and resources departments is essential.

Too often the distinction between tourist promotion and public education on resources is not observed, largely because of lack of liaison and understanding between all levels of officials specializing in one or another field. It is the part of the information and education agency to ensure that the tourist agency is supplied with facts about the resources, and is given closest co-operation in procurement of photographs, news and feature items of interest to potential tourists, and in becoming familiar with the recreational potential of the province and Canada as a whole. On the other hand, the tourist agency should present its material in such a manner that public knowledge of resources is enhanced and the public is not misinformed about matters pertaining to resources management. Good relationships may multiply the ability of each agency to do its job effectively. Conversely, failure to achieve close liaison and understanding may lead to important difficulties and neglected opportunity.

Problems between information and education agencies and other public relations and publicity agencies may be resolved by clear definition of terms of reference, close liaison, and meticulous respect for the professional standards of each party.

Need for Separateness of Identity Among the Government Publicity Groups

The Canadian public and the press may reasonably oppose a proliferation of government-operated public information services. Reasons for opposition may be as direct as the question of whether value is obtained for money spent. Or the reasons may be as complex as the question of how far government may intrude into the information dissemination field before encroaching on the prerogatives of a free press, thereby weakening the democratic process. On the other hand, the survival of any society depends on the effective management of its renewable resources. And many administrators believe that successful management has an essential component — effective public information and education.

There appears, in the above, to be an incompatibility between two legitimate attitudes. Success or failure in resolving it may have far-reaching consequences for the future of information and education as an instrument of resources management. It is essential that government administrators, public media editors, and the general public, should recognize that information and education agencies have functions distinct and different from those of government-employed news reporters, tourist promotion writers, general public relations men, industrial development writers, and so on. Until this separateness of function is recognized by treasury personnel, civil service commissions, editors, and the public, agencies specializing in the presentation of scientifically accurate popular material on resources management will be caught in a dilemma. Wage scales and personnel selection and training methods will inhibit the early development of the essential cadre of professional information and education men. This in turn will inhibit and retard definition of the information and education function, method and professional criteria.

Timing

Industrial public relations personnel know that a well-planned, well-executed campaign to influence public opinion may fall flat if the timing is wrong. However, a mediocre campaign may have exceptional results if the timing is favorable. The timing of a program is unfavorable if the campaign is intended to counteract pu-

blic opinion already strongly held. By the time public pressure has become widely evident, the time to place the facts of a situation before the public is long past. Each administrative measure in resources management must be accompanied or preceded by a suitable program of information. The public may then arrive at their conclusions on the basis of objective discussion rather than rumor. Such an approach may make a significant contribution to operational effectiveness. *Feedback* – the reaction of the public to a proposal – is an important factor in resources administration. Assessment of the public reaction demands technical skill of a high order. The result is more sensitive interaction between government and people.

Information and Education, and Obscurantism

The highest-placed, most responsible industrial public relations officers believe that they may not put forth incomplete or inaccurate information. To do so, they believe, is career suicide. "If you cheat, no editor will trust you; if editors don't trust you, no responsible organization can afford to." Many highly paid professionals will not place their reputation for integrity in jeopardy even at the specific behest of their employer.

It is a question of considerable importance to resource departments whether resources information and education agencies will establish reputations for objective reporting of resource management situations, or will be used to whitewash mistakes, obscure difficult administrative situations, and enhance political reputations. They cannot do both.

The Place of the Non-Government Organization

There may be some question as to the propriety of a government developing a public information agency of such potency that it must be demonstrably capable of influencing the behavior of the general public. In this regard, information and education organizations can be viewed in two lights: first, as one of a large number of organizations attempting to get the ear of the public for ends more or less valid; and second, as an educational organization with the mandate of society to provide members of the society with the knowledge of how to live in harmony with their environment – which, after all, is the ultimate goal of any educational activity worthy of the name.

Notwithstanding this, highly developed government-supported information and education agencies must have their counterbalance in the form of equally well-developed non-government resources information agencies. Any government, however well-intentioned, may be unwilling to publicize matters which reflect adversely on it, whether or not it is in the public interest that the facts be known. And governments have a natural tendency to avoid controversy. Therefore, foundations or other organizations might carry out a worthwhile function in hiring or subsidizing qualified information and education writers to maintain close touch with government activities and other resources use activity, and objectively report the facts.

Such an arrangement would bring controversial material into the open in an objective manner, stimulate the unearthing of a great variety of obscure material which it would not normally pay a free-lance writer to *write up* and provide a large fund of accurate, well-written material for low-paying daily and weekly papers and small specialized publications.

In this connection it may be appropriate to cite the example of the Conservation Council of Ontario, a private, non-political organization whose objectives include public information on renewable resources. The Council is unique on this continent in that it represents all renewable resource sectors, including community and town planning organizations, is not a special-interest body, and derives all its funds from sources other than government. It is thus free to view resource problems objectively and to make the facts known to the public and to the government itself.

Centralized Information and Education Services

The activities of the federal government in the resources information field are based on terms of reference somewhat different from those of the provinces, and thus merit separate consideration. In the main, federal information and education work seems to have been limited to the publication of research material, some natural science material, and travel and recreation material (exceptions being the Department of Fisheries and the Department of Agriculture).

Such near-abdication of the field of resources information and education is not generally considered by federal officials as being part of a firm policy. Rather, it is a result of lack of administrative association with natural resources together with a natural reticence to intrude in a provincial field. However, a number of individuals from provincial governments, universities and various organizations have expressed the opinion that the federal government or some equivalent national agency should assume responsibility ifor certain information and education functions which would be inefficient or redundant if carried out individually by the provinces. Among the categories suggested by one or more individuals are:

(1) Regional or national information clearing houses for:
    (a) popular information and education material,
    (b) scientific and technical material;
(2) A film library of:
    (a) popular resources films,
    (b) technical and scientific films;

(3) A production unit for:
  (a) popular written material,
  (b) scientific and technical interpretive material;
  (c) the pooling of requirements of provinces to achieve economy of production;
(4) A system of subsidy for:
  (a) provincial government information and education agencies,
  (b) non-governmental organizations and groups,
  (c) free-lance writers, photographers and motion picture producers;
(5) A central library of technical and popular resources material.

Comment on the desirability of establishing any or all of these centralized services is beyond the scope of this paper, but the matter might be a subject for discussion at the Conference and elsewhere.

List of Contributing Authors

Listed are authors whose papers appear in either of the two volumes. The first number refers to the volume, followed by the page number in parentheses.

Baker, W.B., 1 (157)
Baker, W.M., 2 (981)
Bentley, C.F., 1 (67)
Boan, J.A., 2 (1003)
Brooks, L., 2 (957)
Bruce, J.P., 1 (191)
Camu, P., 1 (479)
Carr, D.W., 1 (123)
Cass-Beggs, D., 1 (173)
Clark, R.H., 1 (191)
Clarke, C.H.D., 2 (837)
Clay, C.H., 1 (325)
Clemens, W.A., 2 (807)
Cottam, C. 2 (919)
Cowan, I. McT., 2 (889)
Craine, L.E., 1 (281)
Crombie, H.L., 2 (969)
Crutchfield, J.A., 2 (739)
Downing, C.G.E., 1 (83)
Drummond, W.M., 1 (37)
Dymond, J.R., 2 (901)
Farina, J., 2 (941)
Forgie, D.J., 2 (717)
Fortin, G., 1 (143)
Fox, I.K., 1 (281)
Fuller, W.A., 2 (881)
Gamble, S.G., 1 (385)
Gertler, L.O., 1 (393)
Gilson, J.C., 1 (101)
Grenier, F., 1 (479)
Hardy, E., 2 (1037)
Harrison, J.D.B., 2 (703)
Hawthorn, H.B., 1 (597)
Holt, L., 2 (683)
Hugo-Brunt, M., 1 (419)
Johnson, Norah, 2 (1009)
Johnson, R.S., 2 (683)
Kerswill, C.J., 2 (823)
Kristjanson, K., 1 (205)
Kuiper, E 1 (337)
Laidlaw, A.F., 2 (815)
Larkin, P.A., 2 (785)
Lash, H.N., 1 (445)
Laskin, B., 1 (211)
Leahey, A., 1 (49)
Leitch, W.G., 2 (909)
Lewis, H.F. 2 (857)
Lloyd, T., 1 (607)
Loughrey, A.G., 2 (845)
Love, D.V., 2 (641)
MacKenzie, W.C., 2 (759)
MacLean, D.W., 2 (703)
Main, J.R.K., 1 (579)
Mair, W.W., 2 (931)
Marlyn, F., 1 (455)
McEwen, E.R., 2 (1027)
McGilly, F.J., 2 (1039)
McMullen, D.N., 1 (345)
Menzies, J.R., 1 (353)
Menzies, M.W., 1 (17)
Moore, A.M., 2 (695)
Munro, D.A., 2 (867)
Nicholson, N.L., 1 (367)
Ozere, S.V., 2 (797)
Paget, A.F., 1 (325)
Parks, A.C., 1 (547)
Patterson, T.M., 1 (227)
Pepler, W.A.E., 2 (731)
Pleva, E.G., 1 (471)
Richards, N.R., 1 (55)
Richardson, A.H., 1 (345)
Richardson, N.H., 1 (445)
Ricker, W.E., 2 (775)
Robillard, C., 2 (951)
Robinson, L.M., 1 (505)
Rowley, H.J., 1 (311)
Sametz, Z.W., 1 (367)
Scott, H.K., 1 (93)
Sewell, W.R.D., 1 (205)
Shefrin, F., 1 (17)
Sinclair, M.H., 1 (487)
Sisam, J.W.B., 2 (669)
Sivertz, B.G., 1 (561)
Slater, D.W., 1 (409)
Smith, J.M., 2 (717)
Solomon, D.D., 1 (157)
Spargo, R.A., 1 (299)
Spence, C.C., 1 (93)
Summers, W.F., 1 (539)
Symington, D.F., 2 (1049)
Thorpe, F.J., 1 (1)
Tunstell, C., 2 (661)
Tyrrell, Joyce., 2 (1009)
Van Vliet, H., 1 (527)
Watt, A.K., 1 (191)
Weir, J.R., 1 (75)
Wilson, D.A., 2 (627)